Railway Age Gazette

PUBLISHED EVERY FRIDAY AND DAILY EIGHT TIMES IN JUNE BY THE
SIMMONS-BOARDMAN PUBLISHING COMPANY
WOOLWORTH BUILDING, NEW YORK.

CHICAGO: Transportation Bldg. CLEVELAND: Citizens' Bldg.
LONDON: Queen Anne's Chambers, Westminster.

E. A. SIMMONS, *President.*
L. B. SHERMAN, *Vice-President.* HENRY LEE, *Sec'y & Treas.*
The address of the company is the address of the officers.

EDITORS
SAMUEL O. DUNN, *Editor*
ROY V. WRIGHT, *Managing Editor*

W. E. HOOPER, B. B. ADAMS, E. T. HOWSON, H. H. SIMMONS, H. F. LANE, R. E. THAYER, A. C. LOUDON, C. B. PECK, C. W. FOSS, F. W. KRAEGER, K. L. VAN AUKEN, E. G. ZACK, GEORGE L. FOWLER

Subscriptions, including 52 regular weekly issues and special daily editions published from time to time in New York, or in places other than New York, payable in advance and postage free:

United States and Mexico.....$5.00
Canada 6.00
Foreign Countries (excepting daily editions)..... 8.00
Single Copies.....15 cents each

Engineering and Maintenance of Way Edition and four Maintenance of Way Convention daily issues, North America, $1; foreign, $2.

Entered at the Post Office at New York, N. Y., as mail matter of the second class.

WE GUARANTEE, that of this issue (the monthly Engineering & Maintenance Edition) 10,750 copies were printed; that of those 10,750 copies 7,402 were mailed to regular paid subscribers to the weekly edition, 1,904 to subscribers who get the Engineering & Maintenance Edition only, 250 were provided for counter and news companies' sales, 1,101 were mailed to advertisers, exchanges and correspondents, and 93 were provided for samples and office use; that the total copies printed this year to date were 403,450, an average of 9,383 copies a week.

VOLUME 57 OCTOBER 23, 1914 NUMBER 17

Contents

*Illustrated.

Air Brake Instruction for Trainmen

The Canadian Northern has issued an air brake instruction book designed especially for conductors and brakemen, leaving out those intricacies which have to do with the engineman's or inspector's work, and which do not concern the trainmen back of the tender. This is a sensible idea. In the progress of developing and perfecting the air brake the equipment has been constantly becoming more complicated, until now there are few men in railway work, aside from those whose duty it is to look after its maintenance, who have more than an elementary knowledge of the details of its operation. It is even doubtful if enginemen in any great number are thoroughly acquainted with the apparatus in all its intricacies. The trainmen must, of course, know well the foundation principles of the brake, and also, in some detail, those parts with which they have to deal directly; but to obtain this knowledge it is not necessary to wade through the mass of material which generally is found in instruction books on the air brake in general. There is no need for a trainman to be such an authority on air brake matters as a general air brake inspector, or even to have as much detailed information concerning it stored away in his head as the engineman needs. The Canadian Northern's book was developed on the Toronto division, is of vest pocket size, and is made up of questions and answers. It gets away almost entirely from the complications of engine equipment and its management. It cannot be doubted that the use of similar methods would prove satisfactory on almost any road; certainly this comparatively small book, with its 28 pages and 114 questions, should prove encouraging to trainmen. A careful study of it should do away with the disheartenment that sometimes follows the poor results obtained in endeavoring to pick out the necessary information from the general instruction books. If a trainman desires a more extensive knowledge of the air brake there is, of course, nothing to prevent his obtaining it but lack of time or energy on his part.

The Lack of Operating Literature

The president of a large eastern road made the remark some time ago that while the engineering and mechanical departments of the railroads were well supplied with literature regarding their respective problems, there was very little literature available relating to the operating department. A study of railway literature confirms this statement to a surprising degree. Several papers are devoted in part or wholly to railway engineering, mechanical and signaling, while the number of books written on these subjects is large. On the other hand, with the exception of the *Railway Age Gazette*, there are almost no publications devoting any considerable space to the study of the problems of operation, and good books on these problems, such as Droege's "Freight Terminals and Trains," are few. This is surprising, in view of the fact that the main business of a railway is to operate trains and the engineering and mechanical departments are subsidiary to this. One important reason for this condition doubtless is the methods of development and the lines of promotion of the men in these various departments. Many of those in the engineering and mechanical departments have received technical educations in universities where they were taught to study their problems from a scientific standpoint and to put their information and ideas in writing. On the other hand, in the transportation department a large majority of the officers began work in the train service and similar branches. Their early work did not tend to train them to analyze their problems in the same manner or to discuss them in writing. It may be largely owing to this that there is only a small amount of railway literature dealing with the handling of cars, engines and trains. There is, however, no more important field for thorough investigation and study and for the exchange of ideas than in the conduct of railway transportation; and it is to be hoped that the next few years will see the production of more literature along this line, for it is along the lines where there is the freest exchange of ideas that the greatest develop-

ment is likely to occur. The *Railway Age Gazette* is trying to do its part in the development of a literature of this kind. The contest on the handling of cars in large classification yards, which we conducted a short time ago, and the later one on the handling of cars in large terminal yards, have called out numerous excellent discussions of some exceedingly important transportation problems; and the more discussions these problems receive the farther their solution will be advanced.

Foreign Criticism of the Rate Decision

Elsewhere in this issue is published a criticism of the Interstate Commerce Commission's recent eastern freight rate decision by the official journal of the German Railway Association, the Zeitung des Vereins Deutscher Eisenbahn-verwaltungen, which compares the commission's report to a "not too weighty scientific treatise." In a recent issue (October 2, page 611) there was also published a discussion of the decision by W. M. Acworth, the eminent English railway authority. It is somewhat remarkable that these two foreign views should so closely coincide with the most critical opinions of the commission's work that have been expressed in this country. If criticism of the attitude assumed by the commission by those most qualified to discuss the situation here may be open to the charge of not being wholly disinterested, or at least of prejudice in favor of the railways, certainly the utterances of an English economist and of an official publication from the land of the most pre-eminent example of government ownership cannot be so characterized. The German publication finds that "thorough treatment of the results of actual inquiries is conspicuous for its absence," and that "the arguments of the commission make no lasting, convincing impression," such as might have been expected from "so high and, because of its power, so very respected a body." Most thoroughly in accord with the American opinion of the decision perhaps, is the following: "Throughout there is a certain irritable tone which in a more or less judicial decision is not in place. Repeated introduction of the misdeeds of individual enterprises and the vehement rejection of suggestions made to it from outsiders were better left out." It would seem that the unanimity of the opinions expressed regarding the decision in this case by those best qualified to discuss it might well lead the members of the commission to a searching of hearts and a recognition of the fact that the commission itself has a responsibility in the matter that cannot be properly evaded, and which nobody but five members of the commission seems to think is being satisfactorily borne.

"Gilded Stairs and Marble Halls"

In a brief impromptu talk to the Chicago Engineers' Club some days ago Charles Evans, chief commissioner of the state railways of Queensland, Australia, paid a high tribute to the railways of the United States. He had traveled quite widely on the railways of Europe, he said, but he had not seen any lines equal in many ways to those of this country. He deprecated the idea of government ownership here on the ground that the task of taking over and managing such an enormous system of railways as ours would be too great for the government. But he had one criticism to offer regarding our railways. This he expressed by saying that they go in too much for "gilded stairs and marble halls"; in other words, that they spend too much money in providing the luxuries of transportation. This criticism, which applies, of course, only to passenger stations and passenger train service, is entirely valid. The railways of the United States have gone mad on the subject of providing enormous marble passenger stations with immense amounts of waste space in them, observation cars, buffet smoking cars, valets, maids, barbers and barber shops, stenographers, unnecessarily duplicated passenger train service and scores of other luxuries which cost money and which are unknown on the railways of any other country. Our railways handle freight cheaper than any other railways in the world; and then they turn around and waste more money in expenditures for elegancies and luxuries in passenger service in proportion to the amount of their passenger business than any other railways in the world. If the public were willing to pay for these things the situation would be different; but it is not willing to pay for them and does not do so. Our good sleeping car and parlor car service is far superior to the first class service of any railways in Europe; but the first class rates in Europe probably average more than our passenger rates plus our sleeping car or parlor car rates; and the European first class rate plus the sleeping car rate is far higher than the similar combination of rates in this country. The passenger service of the United States is usually unprofitable. If it is ever to be made profitable—as it clearly ought to be—it will be necessary to get the rates for it on a substantially higher basis and reduce the number of expensive and extravagant luxuries. The duplication of passenger service on competing lines ought to be reduced; the number of trains carrying observation, buffet smoking and other similar cars, and stenographers, maids and so on ought to be reduced; it ought to be made a rule to charge excess fares on trains on which such special equipment and service are provided, and the competitive rivalry in building mammoth magnificent passenger terminals should be moderated. Passenger service should be made convenient, comfortable, regular and safe; but the "gilded stairs and marble halls" business is being carried entirely too far all over the country.

WHY THE RAILWAY CASE IS UNIQUE

THERE can be no doubt that the public opinion of the nation overwhelmingly supports the appeal of the railways for permission to advance their rates. But in some quarters there is opposition, and one of the arguments made by the opposition is that all of the business interests of the country are suffering from the effects of the war in Europe, and that to allow the railways to increase their rates would be to permit them to shift their share of the burden to the shoulders of other classes of concerns.

But the case of the railways for action that will give them relief is unique. There are numerous important circumstances which differentiate it from the cases of all other classes of business concerns. In the consideration of the rate question it is vitally important that all these circumstances be given proper weight. Among these circumstances are the following:

1. During both good and bad times most other classes of concerns have been free to adjust their charges or prices according to changes in conditions. When the demand for their commodities was large they were able to raise their prices as much as the market would stand, and did so. When the demand for their commodities became relatively smaller they in many cases reduced their prices or charges; and they were comparatively able to do so because of the fact that they had been able to make relatively high prices or charges before. Even since the war began many concerns and producers have been enabled to make heavy advances in their prices. On the other hand, for years the rates of the railways have been stationary. They have not been permitted by public authorities to make any considerable advances in them, and today their average rates are lower than they have been at any time since the period of depression following the panic of 1893.

2. It may be said, as Louis D. Brandeis did say in his brief in the original rate advance case, that public utilities, like railways, have been unable to advance their rates, they also being subject to regulation. But the conditions under which public utilities have operated have been widely different in two important respects from those under which railways have operated. One of these is that each public utility usually is a monopoly, and therefore is not subject to the competition in service which has been such an important factor in increasing railway expenses, especially passenger expenses, year by year. Still more important is the fact that while the rates of

the railways have been kept stationary by public regulation, their traffic, and therefore their earnings, have undergone the widest fluctuations. Their earnings were large in 1907, and were $300,000,000 less in 1908. They were large in 1910 and were badly off again in 1911 and 1912. They were large in 1913 and underwent a heavy slump in 1914. In consequence, while their rates have been stationary, they have been under the necessity of incessantly readjusting their expenses to their traffic and earnings. On the other hand, it is characteristic of public utilities of almost every kind that their business and earnings usually steadily increase year by year, and that if they decrease it is to such a small extent as not to render necessary any very important readjustments in operating expenses. These differences between the conditions with which railway managements and the managements of public utilities have had to deal have been very important. A concern the increase in whose earnings and expenses is uniform and predictable can adjust itself to stationary rates far better than one whose business and earnings undergo wide fluctuations.

3. The railway business has been carried on with an average percentage of return on capitalization smaller than that with which any other important class of business concerns has been carried on. It is often replied to this statement that one reason for this is that the railways have been enormously overcapitalized. Well-informed students of railway problems repeatedly have given their reasons for disputing this charge. It is true that there are many railways that are overcapitalized, but there are still more that are under-capitalized. Suppose, however, it be conceded for the sake of argument that the railways as a whole are overcapitalized to the extent of 50 per cent; what then has been their *maximum* annual net return on actual investment? Not over 6 per cent. Suppose it be conceded for the sake of argument that they are overcapitalized to the extent of 100 per cent: what then has been their *maximum* annual net return on actual investment? Less than 8 per cent. For on their total actual capitalization the railways have never earned an average in any year of more than 4 per cent. Every man who is interested in or familiar with some other line of business, will, if he be honest, concede that the average return earned by concerns in that other line far exceeds the average earned on the capitalization and actual investment represented by railways. All the talk of overcapitalization of railways comes with poor grace from the publishers, the manufacturers, the bankers, the farmers, and every other classes of business men in the United States. When it comes to the art of capitalizing business concerns in excess of original investment the railway managers of America are mere amateurs compared with the publishers, manufacturers, farmers, bankers and other business men of this country. With their narrow margin of return most railways are less able to stand such conditions as the present than most concerns in other lines.

4. The conditions with which the railways have had to deal have been unique in respect to the increases in wages paid by them. Unlike almost all other business concerns, they have been unable, because of the nature of their business and the attitude of the public towards it, to allow wage disputes with their employees to go to the length of strikes. Unlike other business concerns, they have had applied a federal law which, with the backing of public opinion, has made it almost compulsory for them to submit such disputes to arbitration by government boards. The consequence has been that while in many other lines of business the power of the labor organizations has been reduced or broken, in the railway business the power of labor organizations has increased day by day. With the increase of their power has gone an increase in their demands. In every case where a railway wage dispute has been submitted to arbitration the award has resulted in increases in wages. Consequently, practically under government compulsion the railways have made increases in the wages paid to their employees which during the last ten years probably have been greater in proportion than those made to any other classes of working men; and for the same reasons they would now find it most difficult to reduce wages.

5. Unlike most classes of business concerns, the railways have been subjected, through government regulation, to many other increases in their expenses besides the advances in wages resulting from arbitration. Among the different kinds of regulation which have caused increases in their expenses have been legislation relating to the hours of service of employees, to the number of men employed in train crews, to the kind of safety appliances to be used, to the kind of locomotive headlights to be used, to the periods at which employees should be paid their wages, and so on.

6. The railways have been subjected to an unique increase in their taxes. The taxes paid by them advanced from $57,849,000 in 1903 to $129,052,922 in 1913. No other class of property has had to bear such an enormous addition to its burden of taxes, an addition out of all proportion to the increase either in the value or in the earning capacity of the property.

7. Again, the railway situation is unique because of all the securities of American business concerns held abroad and directly affected by the present war, the securities of American railways constitute an overwhelming majority. In consequence, if, when the stock exchanges are opened, European investors begin to dump their American securities on our markets, the railways will be the first of our business enterprises to be subjected to the attack, and they will be subjected to the most severe attack of all. The effect produced upon general business in this country by this dumping process will be determined mainly by the way in which the railways stand up under it; and the way in which they will be able to stand up under it will depend largely on what action is taken by the government authorities to increase their earning capacity either by relieving them of some of the burdens now imposed upon them or by letting them increase their rates, or by both.

In view of the numerous and important conditions which make the position now occupied by the railways entirely unique, it is absurd to talk about them trying to shift their share of the burden of the war on the shoulders of other American industries. The railways were carrying such burdens as no other American industry was carrying before the European war began. That war has imposed heavier burdens in proportion on them than on perhaps any other industry in America, except the cotton-growing industry, because it has reduced their traffic without their being able to make any advances in their rates, and because a larger amount of their securities is held abroad than is true of any other class of American industries. It is because the situation of the railways is unique that they ask relief; and it is because the regulation to which they are subjected is unique that it is necessary for them to appeal to the Interstate Commerce Commission for that relief.

THE NEW ARGUMENT AGAINST THE RATE ADVANCE

THE commission refused the rate advance in 1910 because it was held that the railroads did not need increased revenues; in 1913, because although the roads did need additional revenue, there were other and better ways of obtaining it than a 5 per cent advance in rates; and now it is argued in opposition to the renewed demand that although circumstances have changed, the stockholders of the roads now paying dividends should forego a return on their investment to enable the roads to meet war conditions. The argument as it was developed in the cross-examination of Mr. Willard and Mr. Shriver on Monday has a superficial plausibleness about it that is apt to mislead. The argument appears to be this: The Baltimore & Ohio has been paying 6 per cent dividends on its stock since 1906. To enable the company to do this it has twice been necessary to pay a small part of the dividend from previously accumulated surplus. To enable the company to maintain the 6 per cent rate it was also necessary to cut down expenses to meet increased operating costs by various economies,

including the deferring of maintenance of equipment in the last year. Now there comes a time of emergency. All business men are feeling the effect of this emergency. It is being met on all sides by retrenchment and sacrifice. Why should not the railroad stockholder sacrifice his dividends as business men are sacrificing their profits? If the only change that has taken place since the 1913 rate case was decided is the change caused by the war, is it not fair for the owner of railroad stock, that is, the owner of the business, to take his loss just as other owners are doing in other lines of business?

The argument is fallacious. In the first place, not all of the 38 roads asking for relief are paying dividends; in the second place, no governmental agency is limiting the profits of business men either now or in good times; and there is the point. If the economic law of supply and demand—of charging for a commodity what some one is willing to pay for it—is to hold, there should be no limitation on the owner of a railroad property to make the profits which business conditions will permit of; but if the government is to limit these profits in this one business because the capital invested in it is engaged in public service, then by every law of equity capital invested in public service should be treated differently in a time such as this than capital invested in private business.

All this, however, is academic discussion. The railroads might have all the theoretical justice in the world on their side and still might fail to get their rate advance from the Interstate Commerce Commission, because the commission apparently feels that its duty under the law is to protect the public against the railroads. But this is really not the question that is involved in the present rate advance case. The question is so much larger, so much more momentous and so grimly practical that the one hope of a satisfactory outcome in the present case, probably, is that the commission will grasp, either through the railroads' presentation of the case or through their own study of general conditions, some comprehension of the responsibility which they are now arguing about in so theoretical a way.

Take the question of dividends alone. The savings bank laws of the various states generally contain a clause which forbids the investment of savings bank funds in mortgage bonds of railroad companies which are not paying a certain rate of dividend on their stock and which have for a series of years been paying this or a higher rate. In 1913 the savings banks of the United States held $794,000,000 railroad bonds and stocks. Imagine for a moment what would happen if dividends were to be suspended on roads like the Baltimore & Ohio, the New York Central and the Pennsylvania, necessitating not only a closing of the savings bank market for additional railroad securities, but the transfer of savings bank funds now invested in railroad bonds to other forms of investment, with the consequent dumping on the market of the great volume of securities now held at the time that Europe is demanding that this country buy back a considerable part of the enormous volume of railroad securities which have over a series of years been sold abroad by American railroads. To find a market for their holdings at a time like this the savings banks would have to accept a loss that cannot be viewed with anything but alarm.

This is one of the ways in which a blow to railroad credit would be a disaster, reacting on the community as a whole.

The commission cannot for a moment delude itself into the belief that after all the years in which it has reiterated time and again in its opinions the axiom that although it will not permit a state of affairs by which public service—a natural monopoly—will afford an opportunity for excessive profits to capital, neither will it do anything to make the investment of capital in public service securities less attractive than in other lines of business. What the commission has continually implied in its decisions is, that although the railroad stockholder cannot expect large profits which might be the reward of risk in an industrial enterprise, on the other hand investment in railroad stocks has an element of security which is lacking in the more speculative industrial business. To deny this now would be to deal an unbearable blow to railroad credit.

Letters to the Editor

ANOTHER EXAMPLE OF SAFETY LAST

Seattle, Wash., September 17, 1914.

To the Editor of the Railway Age Gazette:

In your issue of September 11 there is a short article entitled "Think of the Engineman." Cases such as that which was there described are frequent enough. Only last week our road (the Great Northern) came near having a dozen or more law suits on its hands, under the claim that "the engineman was to blame." I was pulling the "Flier" which runs from Seattle, Wash., to Vancouver, B. C. I rounded a curve at a speed of perhaps 50 miles an hour, over which was a crossing at grade—the "Pacific Highway." I always give this crossing a particularly long and loud crossing whistle for the reason that I can see the crossing but a short distance, and a driver on the highway also has a short view of a train approaching.

On the day to which I refer I whistled as usual. As I came in sight of the crossing I saw a cloud of dust rapidly approaching; I threw on the brakes and whistled again, long and loud. But an auto stage loaded with 20 or 25 people reached the crossing at the same time I did. The driver had approached the crossing at a terrific speed, either with the intention of "beating me to it" or else he did not hear my first whistle. He made an emergency stop, pulling up not more than one foot from the train, as I whisked by, my brakes not being able to bring my train to a stop under a half mile, owing to a slight down grade. The engine bell had been ringing from the time I first whistled till I had passed the crossing.

Had there been a smash up, the survivors undoubtedly would have sworn that neither did the bell ring nor the whistle sound.

F. H. George.

CRITICISM OF THE SIXTEEN HOUR LAW

Albany, N. Y., October 13, 1914.

To the Editor of the Railway Age Gazette:

The half dozen proposed new laws suggested by the locomotive firemen's union, as noticed in your issue of October 9 certainly cover a broad field. To the distant observer it looks as though the Illinois scheme must be simply a peg to be used as a convenient support for political wires. As we all know, wire pulling is the life of the politician who has no legitimate issues to promote, and as the firemen have no real need for further legislation at the present time their hired politicians naturally cook up every sort of scheme which promises to be useful in dickering with idle-minded legislators. What sense is there in the firemen's agents' proposal to stir up the legislators on the subjects of uniform signals, the proper number of cars in a train, and the other things mentioned? The legislatures will pass enough useless or harmful laws without the help of the firemen.

But what I want more particularly to call to your notice is the proposal to limit trainmen's work to ten hours a day. Is this a serious proposition, or merely a convenient postulate for use in bargaining for something else? Do they really want shorter hours, or only to get legal approval of a scheme to get more "overtime" pay? It is understood that there is always a considerable percentage of trainmen—firemen, engineers, conductors and brakemen—who are not only willing but anxious to stay on duty 12, 14, 16, or even 20 hours at a time, if only they can get good pay for it. Does this legislative committee propose to override the wishes of such an important element of its constituency? It is hard to believe that this proposal will be soberly pushed, when it comes to definite action.

But, with proper limitations and qualifications, *it ought to be pushed.* In other words, this committee, wisely or unwisely, with good intentions or otherwise, has touched a live issue. The 16-hour law is a great fraud. It has elements of good, for with-

out it men would work 18 hours, and occasionally 24 hours; but its main effect, combined with the provisions for eight hours' rest, is to foster the utterly irrational working-hour schemes which now prevail all over the United States. The arrangement of working hours of men on freight trains constitutes the most absurd, unreasonable, unhealthful scheme for the regulation of personal habits that anybody ever heard of. The plan is worse than the customs on shipboard, where men sleep only four hours at a time. To plan deliberately to make men's rest hours as irregular as it is possible to make them would be justifiable only (1) in case of dire necessity, or (2) regardless of necessity, where their work is so easy or so unimportant that it does not make any difference whether they do or do not come on duty fresh and rested. No such conditions exist on the railways of America.

The plea of the labor-union law-makers is that railroading is such a dangerous business that trainmen, with their delicate responsibilities, must take extra good care of their health. As a matter of fact the 16 hour rule, combined with the "chain gang" list—"first in first out"—is used to make the hours of freight trains as irregular as possible; to *impair* the men's health so far as rules for working hours can be made to impair it. The only reason that these very irregular hours do not do more harm than they do, is that the men can and do rest a good deal while they are on duty. For conductors and brakemen this is quite easy. For the fireman the situation generally is bearable if he is able to get the assistance of a friendly brakeman occasionally. Even the engineman can get a little relief now and then, especially when waiting on a side track, by entrusting the engine to the fireman.

The establishment of a ten-hour work day by law would be a good thing, if in connection with it, it were possible to establish a 14-hour rest day, and if proper provision were made for emergencies when longer hours were necessary, temporarily. Regulation of this matter by statute is difficult at best; but let us be rational in whatever legislation is enacted. The legitimate reason for reducing hours of labor is to increase the hours of rest. A law, however, cannot compel a man to rest when he prefers to go to the theater or to work to excess in his garden. The most useful thing that any legislature could do for the trainmen would be to enact that ordinary common sense should apply in the arrangement of their hours—as it does in the preparation of work-hour schedules in most other employments. It is reasonable for a man to work ten hours a day, six days in the week. This implies that he should rest six nights in the week. The man who works six nights should rest six days. This principle is so axiomatic that I would not use the ink and paper to state it, but for the idiotic violation of it which so widely prevails. To work 16 hours, rest 8 hours, work 10, rest 28, work 16, rest 12, and so on, never recognizing either night or day, is so absurd that we should ourselves laugh at the scheme if once we examined it soberly. Why does the government tolerate it?

The ten-hour day would be a very attractive idea if its administration were put into the hands of the right kind of men. The railroad superintendent (making proper reports to the government) should have extensive leeway to provide for unforeseen difficulties. Twelve hours a day does no harm for a week at a time, if circumstances are favorable. Sixteen hours is unobjectionable, on occasion, with proper safeguards. The main thing to keep in view is to have the matter controlled by a man —the superintendent or trainmaster—who *desires* and aims to have the men work normal, healthful hours.

A rational plan would be opposed. Some men would make less money. But regularity frequently costs money. Some would have to sleep away from home an ordinary night's rest instead of sleeping five hours (calling it eight) and rushing back home regardless of health. This would require the substitution of good sleeping rooms for many which now are so poor that a trainman is actuated by an abnormal desire to get home. But that substitution is called for, anyway.

Our present law merely sets a maximum—16 hours. In any rational rule the first element is not the maximum day but the normal day—say 10 hours. This being settled, the desideratum is to provide regulations for keeping always as close as possible to the normal. H. R.

A SIGNIFICANT PROTEST

St. Louis, Mo., October 5, 1914.

To the Editor of the Railway Age Gazette:

I have before me the October 2 issue of the *Railway Age Gazette,* and note with particular interest the editorial on page 590 protesting against the action taken by the secretary of the Illinois Commercial Men's Association.

As one member of this organization, I made an immediate protest to Mr. Cavenaugh, the secretary, and in addition to this have addressed a letter to the Interstate Commerce Commission calling their attention to the agitation that is being raised by Mr. Cavenaugh, and mentioning that this does not represent the attitude of all and probably not the majority of the members of this organization. To the writer's personal knowledge, there have been a great many protests made by members of the Illinois Commercial Men's Association to Mr. Cavenaugh, the secretary, regarding his action, and I am very glad to know that you found the subject of sufficient importance to mention it in the terms which you have on a prominent page of the *Gazette.* F. V. Roy.

THE FOLK-LORE OF ROCK ISLAND

New York, October 19, 1914.

To the Editor of the Railway Age Gazette:

"'What is truth?' said jesting Pilate, nor stayed for an answer." Such is the volatile vague vanishing volplaning conduct by Joseph W. Folk of the Interstate Commerce Commission's inquiry into Rock Island. He starts 20 trains of thought per minute, but nary a one does he despatch to destination.

James Bryce has never said, thus enabling us to beat him to it, that the trouble with democracy is that too many second-string men get into first-string places. The position of chief counsel to the commission is of the first magnitude. Of its occupant's rating, may this narrative eloquently tell!

Let us first nail the lie, repeatedly told from Washington, that this investigation was instituted by a resolution of Congress. It was not. Neither Congress nor the Senate, nor the House ever adopted the resolution proposed by Green of Audubon, Iowa—a name and habitat suggestive of the open air, not of hot air—nor did the House Committee on Interstate Commerce ever report it favorably. Instead, the committee dodged the issue by passing a "resolution" of its own, an action utterly devoid of legal status or dignity. This "resolution" its chairman mailed to the commission. The commission entered an order which mentioned the above "resolution" in its preamble. But the order rests solely upon the commission's authority to investigate "carriers," and the responsibility for making the order is squarely upon the commission. So it alone must be held blameworthy for the investigation itself and, as well, for dragging it out on the Friday and Saturday just preceding Monday's rehearing of the eastern rate case.

Here is specimen No. 1 of Folk's arithmetic and love of truth. He could hardly contain himself until witness Sharood, a fair and capable examiner, had stated that the aggregate capitalization of the two holding companies was $350,000,000, thus enabling Folk to mouth the phrase, "swimming in water five times its volume." Now, bad as is the Rock Island's corporate overhang, it is not so bad as that. Folk computes:

New Jersey Company preferred	$49,000,000
New Jersey Company common	90,000,000
Iowa Company stock	145,000,000
Iowa Company bonds	71,000,000
	$355,000,000

But he declines to admit that *all* the Iowa company stock is held by the New Jersey company, unsold and unsalable, thus reducing his total by $145,000,000, or to $210,000,000. This

method of treating stocks of subsidiaries is not only sanctioned but required by the commission's own rules of accounting. It would be fair also, we venture, to deduct some $20,000,000 of New Jersey company stock issued solely upon the acquisition of the *Frisco*, thus leaving a total of $190,000,000. There was $71,000,000 of old Railway stock exchanged, so instead of five times its volume, the "water" is less than 2¾ times its volume, or about half what Folk's question asserted.

At this point we might inquire, What is water? In the curious Rock Island structure, no one paid any money; and the very thing he surrendered was held intact to support what he took in exchange. Call it inflation of par values, if you like, but not "water." Watering, ever since Daniel Drew drove his intentionally thirsty kine to the trough, has meant that the investor paid for something that was not there, for aqueous sirloins. But the Rock Island stockholders neither paid a cent nor lost any values they possessed. If they held till today what they got in 1902, they are entitled to receive their old *railway* stock back. Indeed—and here is a really reprehensible feature, often sharply criticized—they could have sold their New Jersey company stock and still retained, through the Iowa company bonds, their rights in the old *railway* stock up to $100 per share. As events have turned out, it is worth less than par, a result presumably never dreamed of in 1902, and the Iowa company bondholders will get *all* the old *railway* stock, the New Jersey stock thus becoming valueless. It is idle to say that this result was inherent in the situation, or that bankers, brokers and financial writers invariably pointed out this possibility. The fact that the stock was created and made purchasable, so that unthinking investors could pay money for it in the belief that it controlled (as it did while the sun shone) the earning power of the old *railway*, is much to be deplored. Still more deplorable were certain restrictions in the fundamental documents of the two holding companies, notably the right of the New Jersey preferred stock to elect a majority of the New Jersey board, and the covenant in the Iowa bonds never to increase the old railway stock. This latter feature was financial hari-kari. A corporation which as late as 1912 could sell mere debentures on a 5.3 basis, could certainly have sold preferred stock in the years preceding and thus have obviated the stringency resulting from its unwisely limited annual bond issue for improvements and new property. This stock financing should have been easy for the Rock Island, as it has less than one-third as much stock outstanding as the Burlington has, or the Milwaukee or the Santa Fe, or the North Western.

Far—but not too darned far—be it from me to suggest that critic Amster and critic Folk ever confer. Indeed, there were a few minutes when patriot Folk urged that the Iowa bondholders refrain from enforcing their collateral for a few years, so that something might be left for the New Jersey stockholders, this being a paramount issue which patriot Amster has thus far overlooked. But let a plain chronicle suffice. Late Saturday afternoon, James N. Wallace was put on the stand, and quizzed about the plans of the Iowa bond committee. Folk actually read from Samuel Untermyer's brief on behalf of Amster, and used the arguments of Amster's counsel to support Folk's claim that the old railway stock ought not to be sold at the present time, despite the fact that a federal court—not Mr. Wallace's committee—has already ordered it sold. And now observe a further curious coincidence. Counsel for the Rock Island read a passage from Amster's own petition, which he swore to and from which brief-writer Untermyer deviated for devious reasons, to the effect that the *immediate* sale of the old railway stock is *imperatively necessary*. Late Saturday afternoon there was served in New York a further Amster petition amended, *inter alia*, to conform to brief-writer Untermyer's belated convictions, and on Monday morning Amster's advertisements flared forth the iniquity of early sale of the stock! I do not say that this is other than a coincidence; but do say that, if it were other, then the commission would be in pretty poor business.

The *Railway Age Gazette* said last week that Mr. Folk would not disclose a single new important fact. Nor did he. The companies themselves reported the 1909 Frisco transaction in their next ensuing annual reports in the fall of 1910, and were then and thereafter soundly castigated in the public prints. The loss, it is true, was only some $7,300,000, though Folk unblushingly endeavored to create the impression that it was $35,000,000. To do this, he used the book entry in the property account of the Iowa company, which was made up by adding together its $17,000,000 or so of "Frisco 5s," and the $18,000,000 of New Jersey common stock delivered to former Frisco stockholders. But these are obviously par values only, mere counters. The New Jersey stock cost nothing in cash, and against the $17,000,000 of Frisco 5s the Iowa company received from Yoakum and associates $10,850,000 cash, which (adding to the bonds their premium and interest paid on redemption) left the Iowa company $7,300,000 to pay to redeem its bonds, which is the sum total of the loss on Frisco. Yet Governor Folk would stamelessly foist upon the public a mere book entry, made up, as the commission requires, on the basis of par values, to lead us to believe that the Frisco loss, bad as it was, was 400 per cent bigger.

The loss on the Alton transaction has long been generally known and denounced. But it also was made to appear greater than the facts warrant. It will be recalled that the Rock Island sold most of its Alton stock to the Clover Leaf, receiving the latter's bonds. The stock cost some $9,000,000, against which Counsel Folk allows the proceeds of Clover Leaf bonds sold, but does not allow any value whatever for the unsold $5,447,000 of these bonds, beyond the value of the pledged Alton stock. Despite the fact that the Clover Leaf stock has a market quotation, the commission's witness declined to concede that its promise to pay, though senior to the stock, has any value whatsoever! He excused this by claiming that the trust agreement gives no recourse beyond the pledged stock, which is his opinion and unfortunately is mistaken.

This witness acknowledged that books had been thrown open to him and every facility afforded, and his testimony showed that he had dusted every cranny, and yet under Brother Folk's guidance we find him taking these strenuous measures to make a loss greater than it can conceivably be. What can it profit a corporation to acknowledge its fault and own that its sins are ever before it, if its penitent candor is to be abused by stretching plain figures beyond recognition?

Throughout the hearings ran the claptrap that the public is "taxed" to pay interest and dividends on the mass of watered Rock Island securities. If so, the rate of taxation has been very light. The New Jersey common has never paid a dividend, the preferred has paid none since 1905; and the Iowa bonds, par for par of the old railway stock, paid 4 per cent to and including November 1, 1913. Not heavy taxation for some 8,000 miles of railroad. In fact, the Rock Island is an excellent illustration of the circumstance that no railroad whose securities have ever been called "watered" is paying any returns whatever on the water. The Rock Island never has claimed and never could have claimed that rates should be fixed so as to allow dividends on the stock of its overlord, the New Jersey company. Yet these sessions were replete with suggestions that this capitalization is the basis for a plea for higher rates. If the commission had ever for a moment considered fixed charges in determining rates, or if the commission were not now engaged in physical valuation in order to escape from security standards and stock market values, there would be a shred of merit in these suggestions. As the facts stand today, however, they are the silliest buncombe. RAILWAY BONDHOLDER.

NOTES FROM CHILI.—The Howard Syndicate notified the Chilian government that it would make delivery of the Southern Longitudinal Railway on August 1. It is stated that there was danger of a general railway strike in Chili owing to the dismissal of a number of employees on the state railways.

The Rehearing on the Rate Advance Case

Daniel Willard's Opening Statement is Given in Full and a Summary of the Cross-Examination is Also Given

At the hearings in the reopened rate advance case at Washington on Monday, Mr. Willard, president of the Baltimore & Ohio, presented the following statement on behalf of the railroads:

MR. WILLARD'S STATEMENT

The railroads operating in Official Classification Territory, and parties to the so-called "Five Per Cent Case," now appear before this commission as petitioners and respectfully require that such modification be made of the report and order of July 29, 1914, as will enable the carriers to put into effect the rates which were therein directed to be canceled.

Subsequent to the filing of the report and entry of the order of the commission in the cases known as Docket No. 5860 and I. & S. Docket No. 333, facts and circumstances have arisen which could not possibly have been foreseen upon the date when the order was entered. A war of unprecedented proportions has broken out, and this, taken in connection with the facts already in the record, with such additional information as the carriers are now able to furnish, clearly indicates such a situation as your petitioners believe fully justifies the relief now prayed for.

The tariffs above referred to were originally filed by the railroads in October, 1913, and are intended to provide for a general advance, with some exceptions, of approximately 5 per cent. of all freight rates in Official Classification Territory. In support of the advanced tariffs the carriers pleaded, among other things, inadequacy of revenues and the commission in its report on July 29 used these words:

"In view of a tendency towards a diminishing net operating income as shown by the facts described, we are of opinion that the net operating income of the railroads in official classification territory, taken as a whole, is smaller than is demanded in the interest of both the general public and the railroads, and it is our duty and our purpose to aid, so far as we legally may, in the solution of the problem as to the course that the carriers may pursue to meet the situation."

It should be kept in mind that the words just quoted were written previous to the 29th of July, 1914, and before it was possible to foresee or weigh the great events which have transpired since that date. However, with such facts before it as were developed in the original record, and in furtherance of its announced purpose to aid so far as it legally might in the solution of the problem then confronting the railroads, the commission approved of certain rate advances in Central Freight Association Territory, and suggested the propriety of other advances and changes of practices which, if found practicable, would inure in varying degree to the advantage of all of the roads involved in this proceeding.

The carriers are not unmindful of the great significance of the words just quoted from the commission's report in this case, and they do not doubt that, with the assistance of the commission, additional net revenue may eventually be obtained along the lines suggested, and definite action has already been taken concerning many of the subjects referred to, and all are receiving earnest consideration, but the needs of the carriers are pressing and immediate, and the measures of relief proposed by the commission will not in our opinion adequately meet the existing situation.

In order that the commission may intelligently consider the whole subject as affected by present conditions, it would seem necessary to supplement the original record with such additional facts and figures as are now available, showing operating results of these carriers since the case was submitted on May 29. The railroads, in support of their claim of inadequate revenue, filed statements showing the result of their operations for a term of years to June 30, 1913, and in its report the commission considered also the monthly statements of the railroads up to and including the first eleven months of the year ended June 30, 1914. The carriers are now able to furnish complete reports for the entire fiscal year of 1914, and we desire to offer this additional and supplementary evidence, believing it to be essential to a proper determination of the case.

The combined statements of all the railroads involved in this proceeding for the fiscal year ended June 30, 1914, show roundly that the total operating revenues during that year were approximately $48,000,000 less than during the previous year, while the operating expenses during the same period were approximately $22,000,000 greater. The net operating income of these companies for the same period amounted to $260,000,000, or approximately $76,000,000 less than was earned during the previous year, and equal to but 3.98 per cent upon the property investment, a lower return than was shown at any time in the preceding fifteen years. The income, applicable to interest, dividends and surplus during the fiscal year just closed, was $265,700,000, or 4.06 per cent upon the total capital obligations, this return also being lower than any in fifteen years. The operating figures for July and August have been tabulated and will be presented to the commission, and they also serve to emphasize the tendency towards diminishing net income, which the commission found in the facts in the record as originally submitted.

The carriers by documentary evidence and witnesses, if desired, are prepared to support the general statements just made.

While the additional figures now submitted clearly establish a continuation of the recognized tendencies toward a diminishing net income, the actual situation which confronts the railroads today, as revealed by the information now available, and because of the unforeseen and unprecedented events which have taken place since July 29, has become extremely critical. The problem is no longer one of tendencies, but has become instead one of actual reality.

A war such as that now raging causes great and immediate disturbance to industry, commerce and finance. It causes contraction of credit and great restriction, if not the actual stoppage of international trade as well as serious disturbance to domestic commerce, and as we have seen, it has thrown the security markets of the world, first into panic and then into suspension of operations. These have in fact been the immediate, direct and clearly apparent consequences of the war which began less than three months ago; but the ultimate and more lasting consequences are almost as plainly to be seen and will certainly follow, if they do not accompany, the conditions mentioned. These are: enormous destruction of wealth, with great diversion of labor and capital to unproductive employment, thus causing a check to the world's accumulation of new capital, and a serious and prolonged rise in the rate of interest, and the effect of such higher interest rates will continue long after the present emergency has passed, because they will be reflected in the basis upon which the new securities will be issued from time to time as required for refunding and other purposes; and in so far as the war and its consequences tend, as I have just shown, to change the conditions surrounding the enlistment of new capital, they tend to change the fundamental relation between railroad and shipper.

The cost of capital is one of the important elements of the cost of transportation.

It is known that the railroads of the United States have over $520,000,000 of outstanding obligations which will mature and must be met within the next twelve months alone, and it was shown in the original record in this case that the railroads in Official Classification Territory only, had spent approximately $200,000,000 per annum upon their properties for improvements and extensions during the last ten-year period, and it will be necessary to continue such expenditures if the roads are to

maintain their standard of service and provide for the growing needs of the future. Further, as nearly as can be ascertained, there are more than $3,000,000,000 par value of American railroad securities held abroad as investments. The demands for cash in Europe, growing out of the present situation, will doubtless result in large selling of such securities when the markets or exchanges are again opened, and the possible effect of such selling upon railroad credit and related subjects is causing much concern.

With all of this in mind it will readily be seen that the available supply of and probable demand for new capital, as well as the interest rates thereon, are matters of great importance, not only to the railroads, but also to those who depend upon them for transportation, and in our opinion a proper determination of this case cannot be made unless these matters as affected by existing conditions be given full consideration. I shall not dwell further upon this important phase of the question, however, because others who are deeply interested in the subject have asked to be heard in that connection.

The case of the railroads, as so frequently pointed out, is quite unlike that of a private undertaking. The railroad, because of its public character and the terms of the charter under which it is permitted to operate at all, is subject to governmental regulation, not only as to the charges which it shall impose, but also as regards many of the details of operation, and on that account is unable, like the private enterprise, to readjust its rates and practices to meet such a situation as now exists unless and until the necessary approval is obtained.

Finally, it is respectfully submitted that whatever the outcome as concerns these railroads might have been, had there been no war, as a matter of fact there is a war and a grave emergency now exists. It is hardly necessary to suggest that if the commission in view of the present situation, should now conclude, after consideration of all the facts, to approve the tariffs as requested, and should it at any time later on appear that the situation had changed and the emergency had passed, and should it further appear that the carriers involved in this proceeding were then, taken as a whole, in such condition as to earnings, maintenance charges and return on capital obligations as to justify a reconsideration of the action now prayed for, this commission would have ample power to order at any time such reductions as might be fair and reasonable, and I am of opinion that the carriers would not oppose such action by the commission when conditions such as I have enumerated shall have been established.

Following the presentation of the above statement, Mr. Shriver, vice-president of the Baltimore & Ohio, offered a number of statistical exhibits, after which Mr. Willard returned to the stand for cross-examination.

Commissioner Clark began the cross-examination of Mr. Willard by asking him if all the roads in the case showed up like the Delaware, Lackawanna & Western; whether there would be any justification for the advance in rates.

"I would not think so," replied Mr. Willard.

Mr. Willard said that on the Baltimore & Ohio there had been a large retrenchment in expenses and he believed that a similar step had been taken on other roads both before the war and since.

Louis D. Brandeis then questioned Mr. Willard as to the necessity for additional revenue for the Baltimore & Ohio. Mr. Willard said among other things that the railroad needed additional money to meet $35,000,000 of notes which are to mature in June next. These notes bear 4¼ per cent interest. He said the road had 30,000 stockholders and the last dividend was partly out of surplus, $2,000,000 being taken, which left about $32,000,000 surplus still. He added that he still adhered to the contentions made by him at the hearing of the case last spring.

"The effect of the war," said he, "has been that it has accentuated the falling off in business."

He said the Baltimore & Ohio was able to get money at 4½ per cent in June last, but that this was now changed, and he pointed to the fact that the city of New York recently paid what amounted to 7 per cent for money.

"Is not this situation an argument for a reduction of your dividend?" asked Mr. Brandeis.

Mr. Willard replied that in July last when he recommended the continuance of the 6 per cent dividend, he felt justified in the hope that conditions might get better and he intimated that the subject would receive consideration.

Mr. Brandeis then said that the figures showed that the Baltimore & Ohio and other carriers had reduced maintenance charges, equipment charges, discharged employees, but had not reduced dividends. He criticized the former connection of the Baltimore & Ohio with the Cincinnati, Hamilton & Dayton, and asked Mr. Willard if this connection had not cost the Baltimore & Ohio $22,000,000 in actual money and possibly obligations amounting to more than $20,000,000.

Mr. Willard said that the Baltimore & Ohio had a tangible surplus of more than $32,000,000 today, and he declared that on the last quotation the Baltimore & Ohio holdings of Reading showed a profit of $13,000,000 which had not been included in this surplus. He insisted there was nothing in the record to prove that the Cincinnati, Hamilton & Dayton obligations would have to be taken up.

"Is it not a fact that you are asking this commission to levy a war tax in favor of the railroads?" asked Mr. Brandeis.

"No, sir, I do not think so," replied Mr. Willard.

Mr. Willard was asked by Commissioner Clements as to the significance of his statement that $3,000,000,000 of American road securities were held abroad. He replied that it was believed that when the stock exchanges here are opened the demands for cash in Europe will result in a very large selling of these securities and make the condition of the railroads worse. Mr. Willard said that if the railroads were permitted to increase rates it would serve to reassure the holders of these securities and stabilize matters.

"If this commission will allow an increase the foreigners will get a bigger price than now," suggested Mr. Brandeis.

Mr. Willard contended that when the stock exchanges were opened if this country were obliged to take back a flood of American securities held in Europe it would be impossible for the railroads to raise money for needed improvements.

Commissioner Hall suggested that perhaps favorable action by the commission along Mr. Willard's line of thought might result in still larger dumping of securities on the market by foreigners.

"Now, I want to ask you," said Commissioner Clements, "is this application for the purpose of getting more out of the proposed rates for net revenue or for the purpose of establishing credit?"

"Replying to that question," said Mr. Willard, "I reply simply as chief executive of the Baltimore & Ohio. In my opinion the Baltimore & Ohio is a going property, is fairly capitalized, well worth its outstanding obligations and much more. If we are to judge the future by the past it will be necessary for us to spend about $15,000,000 a year for some years to come. I would like to be in a position to recommend to people who write me the purchase of securities, but I cannot conscientiously at the present time recommend to any one to purchase under present circumstances and I therefore think that we ought to have the rates advanced. I think the rates ought to be increased so we can make the necessary improvements to meet the conditions presented."

Then Commissioner Clements, addressing Mr. Willard, said:

"Many industries, large industries, well managed, are now standing still to see what is going to happen; that however bad we think our situation is, it is better than any one else's in the world. Export commodities are being stored and the cotton people are in distress. This condition applies to many lines of business and affects many industries. Is that a situation which should be left out of view when you come to consider an in-

crease of railroad rates, particularly to keep up long standing dividends?"

"The railroad is a semi-public institution," said President Willard. "It cannot close its shop; for instance, 30 per cent. of our passenger mileage does not pay for the running."

Commissioner Meyer then asked: "Do you mean that conditions since July 29, when the commission handed down its decision, have changed, or is it that you want to shift the burden from the shareholders to those who pay the freight?"

"I do not think it will have that effect," said Mr. Willard.

"You propose an increase of 5 per cent," said Commissioner McChord, "which is, roundly speaking, $50,000,000 additional revenue. Will that not be enough?"

"I do not think so," replied Mr. Willard.

"Now," continued Mr. McChord, "the idea then is that this $50,000,000 will put the railroads on their feet and improve business in the country."

"I have not spoken of the country," President Willard replied.

"The country seems arguing for this," said Mr. McChord. "I see it in petitions and in the press and from reports from different portions of the country."

President Willard quoted the commissioner's words in its recent decision: "The public interest demands not only the adequate maintenance of existing railroads but a constant increase of our transportation facilities to keep pace with the growth and requirements of our commerce."

"I simply wish to be recorded as having stated under oath," added Mr. Willard, "that in my opinion with the understanding which I have of the railroads involved in this proceeding they are not as a whole today being adequately maintained; they are not conforming to that condition which the commission set up as a desirable standard, nor are they making proper provisions for the constant growth which they may expect.

"I wish also to state that in my opinion, based upon such knowledge as I have of the business and of the conditions of these carriers, when we shall again be confronted with a condition of business activity, as we may reasonably expect in the not distant future, the railroads in this territory, unless they are in some way put in such position as to justify them to begin immediately to provide facilities, will fall short of being able to take care of the business to a much greater extent than occurred in 1907.

"It should be kept in mind all the time that if the railroads are not adding to their facilities they are going backward. It is a matter of common knowledge today that the railroads are not buying freight cars, they are not buying locomotives, they are not providing additional facilities, and that constantly locomotives and freight cars are wearing out."

Charles A. Conant was then called to the stand. He said in part:

"The cost of the war, if it lasts approximately a year, will not be materially less than $15,000,000,000. The demand for capital for purely war purposes and for the settlements which succeed the war will be so great as to absorb an amount equal to the entire savings for investment made in all civilized countries for a period of several years. The effect of this abnormal demand for capital, which is being consumed without economic profit, will be to raise the rate of interest on investment securities higher than it has been for many years.

"The fact that such enormous sums to pay the costs of the war are sought almost exclusively by means of Government loans will make it impossible to obtain capital for other purposes, except at a rate of interest considerably higher than that paid by Governments. The financial disturbances which will occur during the process of distribution of these Government loans to investors, extending over several years, will involve the sale on the American market of railway and industrial securities now outstanding to an amount which will in itself absorb so much of the new capital available in the United States that it will be extremely difficult to obtain any for new enterprises.

"If, therefore, American railways and industrial enterprises are to obtain any new capital whatever during the next few years, it will be necessary to make issues of securities very attractive, not only in respect to the rate of interest but in respect to the evidence that the interest and dividend payments are absolutely secured by adequate earnings."

Mr. Conant quoted authorities indicating that the world's new capital normally available for investment amounts to about $4,000,000,000 per year. He then concludes:

"If the cost of the war for one year has to be paid out of the amount of annual savings indicated by these figures, then every dollar of new capital for approximately four years will be absorbed in government loans, and there will not be a penny available in any financial market for building a railway spur, putting up a new station or terminal out of capital account, adding a bobbin to the equipment of woolen and cotton mills, or making a single public improvement in the city of New York or any other municipality, except out of current revenue.

"What part the railways will be able to play in wresting a portion of the world's savings from the outstretched hands of the powers which have been blowing away thousands of millions in powder and ball becomes an interesting consideration. They must come into the open market and bid against the greatest states in the world for some scanty portion of the supply of investment capital.

"Leaving aside the question of averting panic, the most important question involved in the return of American securities held abroad is the manner in which it will diminish the fund of capital which is normally available for new investments. In this direction the effect of the European war loans will be acutely felt in this country, even if not a dollar of American money appears as a bidder for the new loans.

"The newer states of the West could never have been equipped with railways, banks, grain elevators, barns and homes, if foreign capital had not been poured into them in hundreds of millions after our Civil War. What will be involved, in effect, if European investors undertake to market a large part of their holdings of American securities in New York, will be the conversion of this gigantic time loan, payable only over long terms of years, into a call loan, payable as rapidly as the securities can be sold on the New York Stock Exchange. It would hardly be within the range of the capacity of the banking system of the country to absorb the entire amount of $6,000,000,000, estimated by Sir George Paish to represent foreign investments in the United States.

"The amount in such securities which is returned to the American market will influence directly the amount of investment capital remaining in the United States available for other purposes. It is at this point that the problem comes directly home to American railway managers and their bankers.

"If the country is subjected to a severe strain, in order to take back from European holders an amount of securities representing the fund usually available for investment for one year or for several years, there will be practically no surplus left for investment in new railway issues."

Moritz Rosenthal, representing the Investment Bankers' Association of America, submitted the proposition that in fixing rates the commission take into consideration factors other than the railroads and the shipper and receivers of freight.

Mr. Rosenthal said he did not assert or propose to discuss the question as to whether the government, either Federal or state, was actually antagonistic to the railway systems. The question is, said he: Does the investor believe that the government is antagonistic to the railroads? To the extent and during the time it exists, railroad credit must pay the penalty. The argument concluded by quoting the words of President Wilson:

"We must all stand as one to see justice done and all fair assistance rendered and rendered ungrudgingly."

Frederick Strauss, of J. & W. Seligman, representing the investment bankers, was the next witness.

Questioned by Mr. Brandeis as to his apprehension over the

probable outflow of gold, Mr. Strauss pointed out that exports showed a much larger falling off than imports. In order to extend to any extent trade in Japan, China and South America, it would be necessary to advance long time credits, and, in his opinion, this country is not now ready to do that. Those who look for large increases in export trade, other than in staples and munitions of war, he thought would be disappointed. Exports of manufactured articles to belligerents are bound to decrease, because they will all try to supply their needs at home. Germany, for instance, will do everything possible to keep her own manufacturers going.

Commissioner Meyer said he had heard of no proposal to start a "buy a share of railway stock" movement. He asked Mr. Strauss if the statement of witnesses for the railway as to the prospects for railway securities were in his opinion calculated to make such a movement popular.

"Have you been accustomed," asked Commissioner Meyer, "to have the head of a great concern come to your office and offer you $20,000,000 of an issue of securities, at the same time stating he would not invest in them himself? In your opinion, how would that affect the credit of his company?"

"Undoubtedly it would tend to shake confidence," the witness replied.

Reverting to the question of dividends, Mr. Meyer asked if the witness did not believe a clientage of stockholders could be built up who would look upon property improvements as a part of their legitimate dividends. Mr. Strauss thought not.

"Then the average stockholder, in your opinion," said the commissioner, "buys income, not property?"

"He has little personal pride in the property," was the reply. "It is too remote from him. He is interested in what he gets out of his investment."

A GERMAN VIEW OF THE RATE DECISION

The Bureau of Railway News and Statistics has issued the following extract from a commentary published in Zeitung des Vereins Deutscher Eisenbahnverwaltungen, the official journal of the German Railway Association, on the recent decision of the Interstate Commerce Commission in the rate advance case:

"Thorough treatment of the results of actual inquiries is conspicuous for its absence. For months, witness after witness and expert after expert were examined. From them a mass of facts for and against the case of the railways must have been brought out. In the decision there is as good as nothing covering all this. The new statistics on capital, traffic, receipts and expenses could have been secured easily from figures already on file with the commission or from reports which could have been made in the shortest time. There was no necessity of spending many months.

"Since there is a lack of concrete foundation the arguments of the commission make no lasting, convincing impression. One would think he was reading a not too weighty scientific treatise, instead of the decision of so high and, because of its power, so very respected a body.

"The occasion surely was important enough for exceptional handling. . . . Yet there is lacking adequate grounds . . . for the sepaartion of the territory into one part where the increase was granted and another where it was refused. The few figures on average rates charged on individual roads in the affected areas are insufficient as a basis for a discrimination so seriously disturbing and cutting so deeply into the industrial structure.

"The impression is given, involuntarily, that the commission had been driven most unwillingly to a decision favoring the increase; and, to please both sides, railroads and shippers, had found no other way out than this, so to speak, local division of spoils.

"Concerning the gratuitous advice given as to how the railways may find relief, there is not much to be said beyond what railroad men have said already. But through the thoroughly impracticable proposal for an increase in passenger rates the commission has opened itself very seriously to attack. . . . The objection can be made with justice that great difficulties stand in the way of raising passenger tariffs, wholly aside from the fact that in a large number of states passenger rates for intrastate traffic are fixed by law, and that from a technical as well as an economic standpoint it is inadvisable to raise interstate fares higher than state fares.

"Throughout there is a certain irritable tone which in a more or less judicial decision is not in place. Repeated introduction of the misdeeds of individual enterprises and the vehement rejection of suggestions made to it (from outsiders) were better left out."

The review closes by contrasting the experience of German roads in a similar petition 40 years ago, when they were granted an increase of 20 per cent to offset higher costs and wages.

EDUCATING THE PUBLIC IN "SAFETY FIRST"

The Southern Pacific, during the past ten months, has given instruction in "safety first" to many thousands of people, not employees—citizens in the larger towns on its lines; and at the same time has advertised its own efforts in the same line by exhibiting models of semaphore signals, hiring rooms for the purpose and employing a regular lecturer. The visual instruction in cautiousness is conveyed by means of large photographs, about a hundred of them displayed in a booth; and whatever urging may be necessary to induce people to walk in and examine the pictures is accomplished by means of the semaphores which are so manipulated as to be an attraction even to the careless.

The pictures illustrate those accidents commonly involving the public, such as trespassing on tracks, automobile drivers approaching crossings not under control, and passengers unnecessarily assuming dangerous positions on trains in motion. In addition to these the results accomplished by the company's "safety-first" organization are illustrated by views of machinery before and after safeguarding and other well known precautions.

All of the pictures, together with statistical accident charts, are displayed in a portable booth 24 ft. long, 15 ft. wide and 14 ft. high. The booth is a counterpart of the one used for the Southern Pacific display at the International Exposition of Safety and Sanitation, held in New York last year. The exhibit travels on an itinerary similar to those of theatrical companies. Advance press notices are published, giving the date and purpose of the exhibition. After the installation of the exhibit, accounts showing accident statistics and other interesting narratives are published in the newspapers. It requires but a day to install and a half a day to dismantle the booth. Where available a vacant store in the business district of each town is selected for displaying the exhibit.

The display of the miniature model of the automatic block and interlocking signals is popular. The public generally is interested in learning the manner in which signals operate and the demonstrations attract many. At the conclusion of each signal demonstration attention is directed to the accident pictures and a brief statement of the purpose of the exhibit is made by the demonstrator in charge. Few people leave the booth without studying the pictures and descriptive data.

A chart setting forth statistics relevant to the carelessness of the great majority of people when crossing tracks at grade is also displayed. These figures, compiled from tests made last year by the Southern Pacific, show, as has been shown elsewhere, that exceedingly few persons stop and look in both directions before crossing tracks, 69 per cent of automobile drivers observed took no precautions whatever, neither stopping nor looking in either direction. Emphasis is given to the fact that the greater proportion of trespassers killed are wage earners and not hoboes, as is commonly supposed.

The exhibit has been en tour since January of this year and with the fulfilment of the itinerary it will have been displayed in all the larger towns on the Southern Pacific system, and will have been attended by 100,000 people; and approximately $5,000 will have been expended in its management.

The Design of Injector Steam Pipe Connections

Recommendations Covering the Design and Material for Brazing Rings, Beaded Rings, Coupling Nuts and Flanges

By Strickland L. Kneass

The report of the chief inspector of locomotive boilers of the Interstate Commerce Commission covering the period from August, 1911, to April, 1913, includes references to certain failures of the copper pipe connection between the turret steam valve and the injector. In the opinion of the inspectors some of these failures might have been prevented if proper care had been used in brazing, or if a better quality of material or an improved design of connection had been supplied. These questions were brought to the attention of the locomotive builders, and manufacturers of locomotive injectors were invited by Wm. Dalton, chief engineer, American Locomotive Company, to meet at Schenectady, N. Y. After an informal discussion, a subsequent meeting was called, and held at Atlantic City during the 1913 convention of the American Railway Master Mechanics' Association. A committee was there appointed, consisting of S. L. Kneass, chairman, F. L. Edwards, L. Kassander and B. T. Williston, to report on the subject. The following is taken from a report on the subject by the chairman:

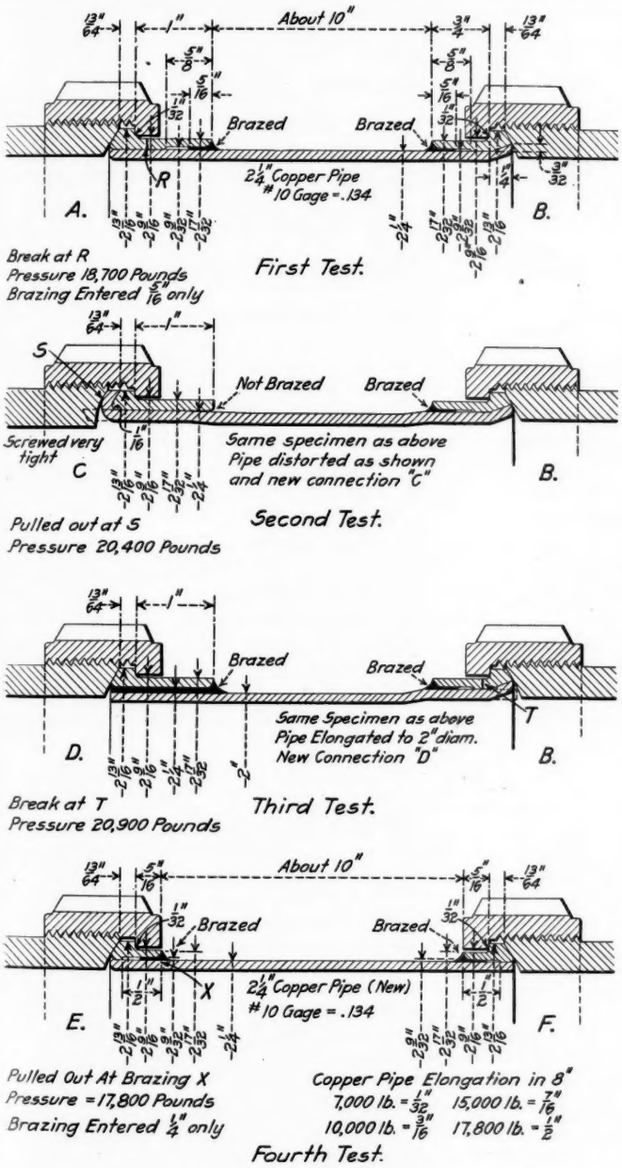


Fig. 1—Tests Made on Brazed Connections by Wm. Sellers & Company, Inc.

The usual method of supplying steam to the injectors of locomotives is by a copper pipe brazed at each end to ball joint rings and held to the turret steam valve and to the injector branch by threaded coupling nuts. This method has been in use since the injector was introduced in this country in 1860 by Wm. Sellers & Company, and follows the general practice of the railroads and injector manufacturers of the continent; on certain foreign railroads brazed flanges are substituted for the threaded nuts. The questions to be discussed cover methods of brazing, its use, the design of coupling nuts and the advantages of other means of holding the pipe connection to terminal branches.

An investigation was made of the strength of brazed connections without change of existing design of the brazing rings. The strain to which the steam connection is subjected in service depends upon the steam pressure carried, the relative change of position of the injector and the steam valve, expansion and contraction of the copper pipe and the vibration of the locomotive when running rapidly. Tensile tests were preferred to hydrostatic pressure as approaching more closely to service strains. The actual strain due to the pressure of the steam is easily calculated, but the other elements are variable and indeterminable, depending upon the bending and fitting of the pipe and the rigidity of the attachment of the injector to the boiler bracket. The strain, due to the steam pressure on a 2¼ in. copper pipe carrying 200 lb. steam is about 600 lb., while the tensile strength of a well brazed joint is 18,000 to 20,000 lb. A brazed joint, supported by the collar of a screw coupling nut, is rigid, so that the strain of bending due to the motion of the locomotive, is borne by the unsupported part of the copper pipe; as this pipe is more or less flexible it yields without damage. Within the connection the brazing material forms a chemical weld between the copper of the pipe and the metal of the ring, and has a higher elastic limit than the copper pipe itself.

Tensile tests were made upon short lengths of 2¼ in. copper pipe with brazed connections at each end held against concave ball seats by standard coupling nuts, using a 100,000 lb. Emery testing machine at the works of Wm. Sellers & Company, Inc. The results, as well as the design of brazing ring, the location of the brazing material and the point of failure are shown in Fig. 1. These connections failed under the following tensile strains:

A	18,700 lb.
B	20,900 lb.
C	Over 19,000 lb.*
D	Over 20,900 (not broken)
E	Copper pipe broke, 17,800 lb.
F	Not broken

*Specimen consisted of the usual type of union with the copper pipe beaded over the ball joint, but without internal grooves in the ring, and not brazed to it. The specimen failed by the copper pipe pulling from ball joint even though the coupling nut was frequently tightened.

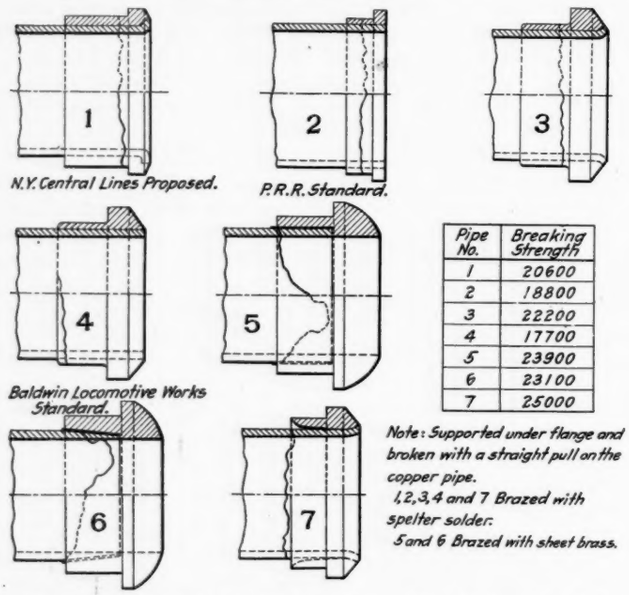
In each of the above cases the copper pipe showed a marked elongation, reducing in diameter under the tensile strain from ⅛ in. to 3/16 in. before failure of the points. Further, the failing pressure was many times in excess of the strain due to service steam pressure. The coupling nuts showed no indication of the strain to which they had been subjected.

The results of a similar series of tests, conducted by the testing department of the Baldwin Locomotive Works, are shown

in Fig. 2. A variety of joints is shown, including cylindrical and taper brazed connections, with and without beads, as well as a reduced length of ring, so that the brazing material would penetrate as far as the collar. The minimum breaking strength was 17,700 lb., and the maximum, 25,000 lb. These tests were made on a Riehle machine, the collar resting loosely on a collet, and the copper pipe held in clamping jaws. They show conclusively the strength of a properly brazed copper joint.

There is no doubt but that the method of brazing and the care with which it is done play an important part in the results. Experiments show the advantage of recessing and shortening the ring so that the strain may not come upon the lighter part of the sleeve, which in many cases is thinner than should be; the real brazed joint between the ring and the copper pipe should be at the ball joint collar, which is held by the coupling nut. The preferred method of brazing is by means of radial jets of the Bunsen type, which can be regulated so as to prevent overheating. This method is superior to the charcoal or coke fire, more easily handled and less liable to burn the metal.

Temperature tests were also conducted by Wm. Sellers & Company upon standard rings of injector manufacturers, to determine the action of these rings when subjected to the heat required to melt brazing material. Two sets of 2¼ in. rings were placed in non-oxidizing atmosphere in a steel crucible;



Pipe No.	Breaking Strength
1	20600
2	18800
3	22200
4	17700
5	23900
6	23100
7	25000

Fig. 2—Tests Made on Injector Steam Pipe Fittings by the Baldwin Locomotive Works

the crucible was then immersed in a lead bath and the temperature raised to 1,850 deg., measured by an electric pyrometer. The rings were then removed and showed no deterioration; each was flattened in a vise from 2¼ in. to 1¼ in. One of these rings fractured at the ball joint; the others stood the test without change. The melting temperature of the brazing wire was found to be 1,400 deg. to 1,450 deg. These tests proved that as now supplied the rings will stand both the melting temperature of the brazing material and the destructive service stresses to which they may be later subjected.

The Interstate Commerce Commission submitted to the committee a list of failures of injector steam connections due either to defective brazing or material covering a period of 21 months from August, 1911, to April, 1913, inclusive. In each case of brazing failure, the work had been obviously done most carelessly. The failure of the coupling nuts was due in one case to poor material, and in the second, to the thread being of too fine pitch.

Each of the 63,000 locomotives under the control of the commission is equipped with two injectors, and each injector has two terminal connections to steam valve and injector, making a total of 252,000 connections. Of these connections, 30 have been reported to have failed during a period of 21 months, an average of 18 per year; this is seven thousandths of one per cent per year, a factor so small as to be negligible compared with the more serious causes of accidents, and one which raises a doubt as to the necessity or advisability of forcing any change of method or design of connection which may destroy accepted interchangeable standards. It is considered desirable rather that more stringent regulations be adopted for methods of brazing and for the composition of the alloy used in rings and nuts. Every effort, however, should be made to reduce the chance of failure and to test any practical suggestions. It is probable that the present brazing ring may be modified so as to insure a more positive chemical weld between it and the copper pipe. Tests have shown that shortening the ring and brazing it directly to the collar of the ring make for security. These changes are shown in Fig. 3 for certain sizes.

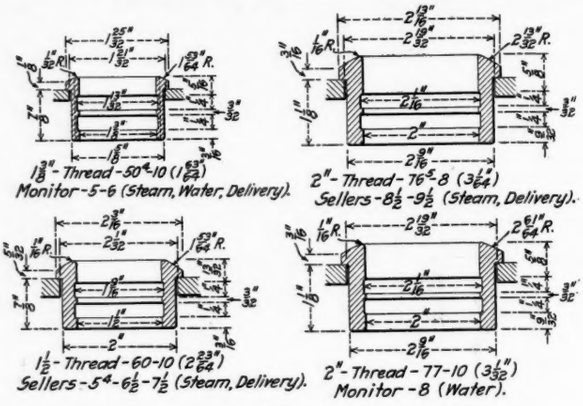


Fig. 3—Brazing Rings for Copper Pipe

A substitute for the brazed joint is a mechanical connection consisting of beading the copper pipe into internal grooves in the ring and flanging it over the lower face to form the ball joint seat. This operation presents no difficulties to locomotive builders or large railroad shops. The flange is set or rolled over the face of the ring without special tools, but care is required to form a true ball joint. The cost of the operation probably does not exceed that of brazing and from data furnished by the American Locomotive Company after using a special form of pipe beading machine the cost may be somewhat less. This form of mechanical connection has the distinct advantage of a direct joint between the copper steam pipe and the injector or valve. This method is comparatively new as applied to locomotive injectors; it is of undoubted value for stationary or fixed joints, but should be thoroughly tested in locomotive injector service before recommendation for general adoption by railroad or locomotive builders.

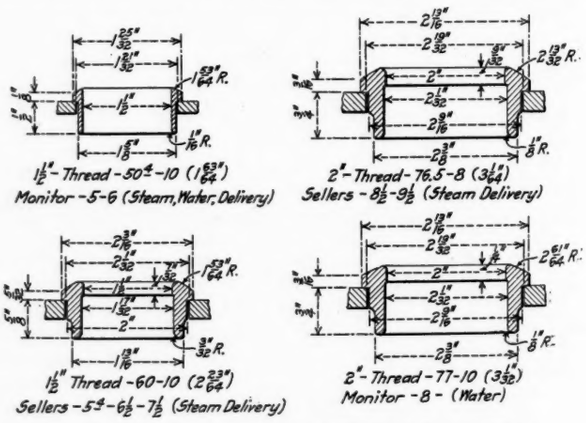


Fig. 4—Unions for Beaded and Flanged Copper Pipe

There are certain objections to this type of injector connection;

liability of damage to the ball joint during the removal or reapplication of the injector; the difficulty of reaming or refacing a fixed ball copper seat without special tools; the difficulty of removing and renewing such mechanically connected ring or ball seat in case of destructive injury; the necessity of shortening or replacing the copper steam pipe in case of replacement of the ring. These several operations can be more easily handled in large shops, but the value of this type of connection can only be determined by extensive service tests on a number of railroads and under a variety of operating conditions.

This mechanical joint can be used with standard injector branches and coupling nuts, and manufacturers of locomotive injectors hold themselves in readiness to supply either form. The dimensions for four sizes are shown in Fig. 4.

The accepted practice of the railroads in the United States and most foreign countries for attaching connecting pipes to injectors and steam valves has been by threaded coupling nuts. There are two accepted standards of injector threaded branches, their diameter and pitch, and their relative position. In view of the acknowledged advantage of retaining these standards, it would be a backward step to make any change that might affect the present interchangeability of injectors unless there were a marked gain in efficiency or in safety to the operatives. As the same ends can be obtained without such change, existing standards should not be discarded.

As a substitute for the threaded coupling nut, a method employing a pair of flanges for each connection is now being tested with lifting and non-lifting injectors, and valves. This method includes one flange screwed on the injector branch, the other bored to fit the collar or ring surrounding the connecting pipe; the two flanges are drawn together by four bolts, holding the flange of the copper pipe or its brazed ring against the ball seat of the injector branch.

This method has an advantage over fine thread nuts in view of their occasional failure and stripping. As it is not necessary to remove the flange when detaching the injector from the locomotive there is practically no wear on the threaded branches. Designs of flanges which are applicable to standard injector connections, giving diameters of bolt circles interchangeable for the several manufacturers, are shown in Fig. 5.

The following recommendations were made by the committee:

Brazing Rings.—To be made shorter; counterbored or tapered internally to permit brazing material to form a joint with ball collar. The end of the copper pipe should be beaded tightly into bevel of ball collar. The composition of brazing rings should be within the following limits:

Copper	87 to 90 per cent
Zinc	8 to 12 per cent
Lead	1 to 1½ per cent
Tin	Not to exceed .4 per cent, and to replace zinc

Beaded Rings.—Rings may have one or more internal grooves about ¼ in. wide and at least 1/32 in. deep. Composition of metal may be left to choice of manufacturer. Rings should be firmly held in split collet fitting closely to outside diameter. Copper pipe may be rolled into grooves by bevel prossering tool or any special device preferred. Flanged ball joint, preferably rolled.

Coupling Nuts.—Diameter and pitch of two accepted standards, Sellers and Nathan, should be maintained. No threaded coupling nuts should be used or recommended having a pitch less than 1/10 in. for diameters over 2½ in.; or less than ⅛ in. pitch for 3 in. or over. Metal should be strong but not brittle, preferably left to choice of the manufacturer. It is considered advantageous to have a different and somewhat harder mixture than that used for the bodies.

Flanges.—It is considered advantageous to use in any future tests, style, form and dimensions of flanges now applied to

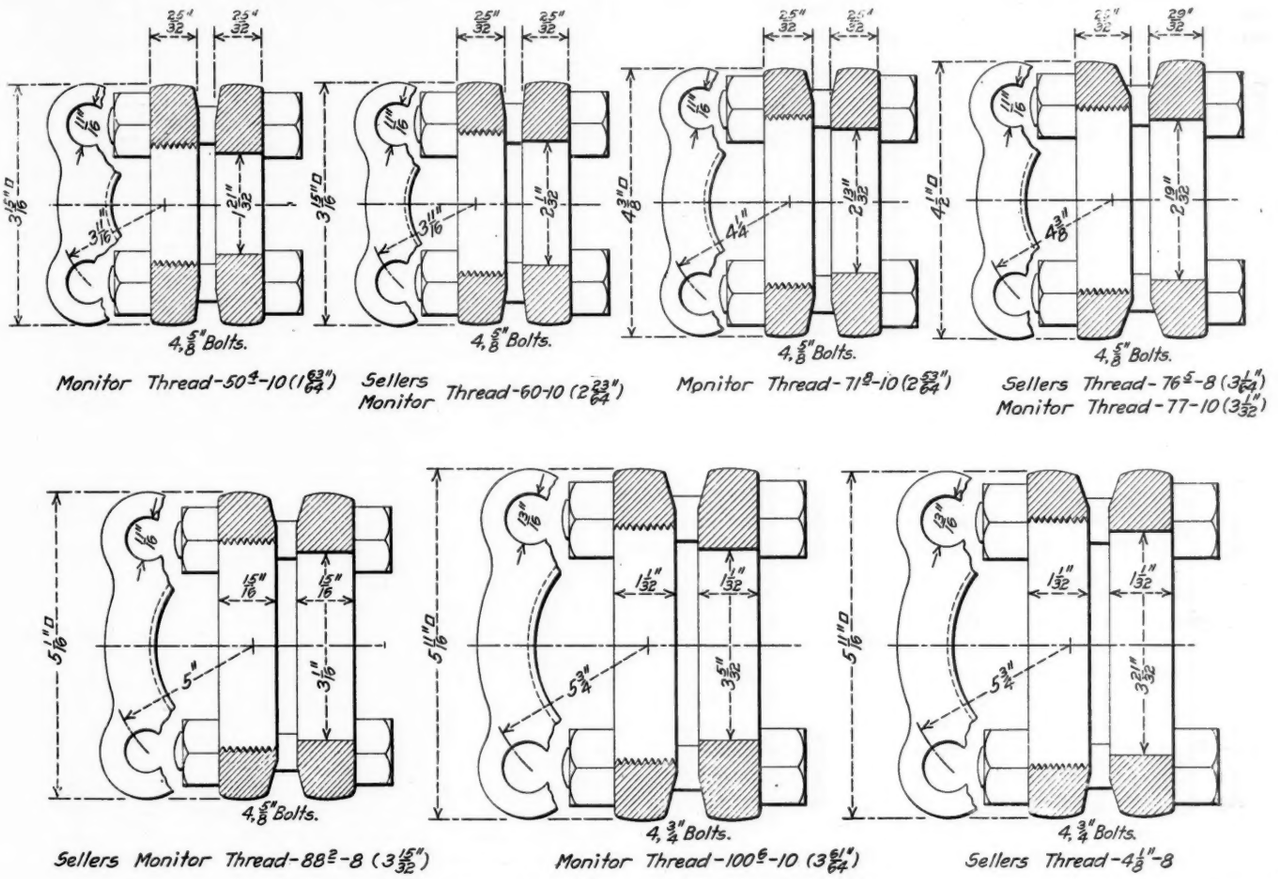


Fig. 5 – Connecting Flanges for Iron and Copper Pipe

Hancock injectors, except that the diameter, pitch and thread may be varied to suit accepted standards of the manufacturer. Material of the same composition as in injector body may be used, but preferably drop forging or cast steel.

Copper Steam and Delivery Pipes.—Pipes connecting turret steam valve or operating valve with injectors should be provided with one or more easy bends of as long radius as admissible, and the total length should be much greater than the minimum distance between the terminal joints. Steam pipes should be designed so as to allow easy flexure during expansion and contraction. Bends should be made so that the outer radius is not strained or flattened and delivery pipes should be attached to the boiler with due allowance for creeping, yet sufficiently firm to prevent distortion of alinement under pressure.

ANNUAL MEETING OF THE AMERICAN ELECTRIC RAILWAY ASSOCIATION

The American Electric Railway Association held is thirty-third annual meeting at Atlantic City from October 12 to 16 inclusive. In the engineering section of the association there were a number of reports and papers presented that possessed matters of interest to the officers of steam railways though they dealt primarily with those pertaining to the electric railway. The papers were presented were as follows: Constitution and By-laws; Power Distribution; Standards; Electrolysis; Accident Prevention; Block Signals; Transportation Engineering; Equipment; Buildings and Structures; Life of Railway Physical Property; Engineering Accounting; Power Generation; Way Matters; and Heavy Electric Traction. The following is an abstract of those papers that contained matters of particular interest to steam railway officers.

BLOCK SIGNALS

The use of light signals for daylight indication on high-speed interurban lines is of comparatively recent origin; a trial of the apparatus of the General Railway Signal Company on the Michigan United Railways showed that, with the sun shining directly into the face of the signal, the red light could be seen about 1,500 ft. and the green light about 1,000 ft.

Discussion.—The discussion was limited to that pertaining to the acceptance of the various recommendations of the committee as to the adoption of standards. To this may be added the statement made that in the formulation of these recommendations it was seen that there were many things that had been successfully worked out in steam railway practice that could be successfully applied to that of electric railways, and that, before any recommendations were made in these particulars it would be well to consult with the engineers of the steam roads and adapt their results to electric railway practice. A number of these engineers had been added to the American Electric Railway Association committee membership, and it is the intention of the committee to embody their experiences in next year's report.

EQUIPMENT

In dealing with the solid wrought carbon steel wheels, the committee stated that, while the number of wheels included in the reports was not large enough to serve as a basis for any general conclusions, a surprising lack of positive evidence on this point was manifest and the figures seemed to show, so far as they showed anything, that there was not sufficient justification for a strong insistence on mating by carbon content.

In the case of air brake hose, it was found that the life was reduced to one-third the normal when oil was present.

With this in view, the committee endeavored to formulate a specification that would provide a hose of sufficient flexibility and strength to meet the severe strains imposed by the sharp curvature of track. Such hose to have also an oil resisting inner tube. It was finally decided that an oil resisting tube should be provided for service where the hose is subject to oil from a motor-driven air compressor, such as in the reservoir line of trains operated by multiple-unit control equipment, and straight air emergency line in city trailer operation. In order to obtain the oil resisting qualities of the tube, the fact was recognized that strength and flexibility of the hose must to some extent be sacrificed, and it was therefore decided that the specification should provide for two classes by grades, i. e., one for use where hose is subject to oil, and the other for general use where these conditions do not exist.

Upon investigation, however, it was found that very little data are available at the present time, with respect to an oil resisting tube on which a specification could be based, and it was, therefore, recommended that the subject be continued next year for further investigation with a special view of investigating requirements and tests for oil resisting inner tube, and to consider such changes as may be found necessary or desirable after putting the proposed specification in effect.

The treatment of car lighting in so far as it relates to the lamps used is quite as applicable to steam railway cars as to those of electric railways. The committee report on lamps says in part:

"The regulation of a carbon lamp is very poor, the intrinsic brilliancy of the filament varying considerably with slight changes in the current passing through it. With varying voltages at the lamp, the intrinsic brilliancy of the filament is constantly varying, and therefore the amount of light obtained from the lamp is also varying, as the amount of light varies directly in proportion to the brilliancy of the filament. The character of the carbon filament is such that its electrical resistance varies with its temperature. As the carbon is heated, its resistance gradually drops, permitting more current to flow through it, this change in resistance occurring only through a limited range, but sufficiently to materially affect regulation. As the voltage on the lamp drops, the current through the lamp drops also, reducing the temperature of the filament. The filament on cooling increases in resistance, and thus causes an even greater reduction in the current passing through it, which explains the fact that with a slight change in voltage there is a great change in the amount of light emitted by the lamp.

"The efficiency of the carbon lamp is low, but until the advent of the tungsten lamp, the efficiency of the carbon lamp was as good as could be obtained.

"The life of the carbon lamp is of a more or less indeterminate length, depending largely upon the definition of life. A carbon lamp will often continue burning for an indefinite period, during which the filament is undergoing changes which materially reduce the amount of light obtained from the lamp. Among other things, the carbon from the filament is gradually oxidized and deposited on the inside of the bulb in such a way as to cloud the glass and cut down the amount of light emitted to a considerable extent. After the carbon lamp has been in service from 1,000 to 1,500 hours, it has usually depreciated to such an extent as to warrant discarding.

"The Mazda lamp utilizes a tungsten filament, which does not vary in resistance with temperature changes to any such degree as does the carbon filament. In fact through a certain range of temperature, there is a slight increase in resistance with increase in temperature, consequently the light obtained from the lamp does not change as much with changes in voltage as is the case with the carbon lamp. This is a great advantage under variable voltage conditions, as the illumination of the car can be maintained more constant.

"The Mazda lamp is a more expensive article to buy than the carbon lamp, but the saving in current to be obtained may compensate for the increased cost of replacements. The life of the Mazda lamp is assumed to be 1,500 hours of burning, as after this point is reached the light produced drops below 80 per cent of normal, which value has been determined as the economical point to discard a lamp.

"There are two important reasons given for using reflectors in

car lighting work, one of which is that by means of proper design a reflector can be made to hide the lamp filament from the eyes of passengers, and the other is that the efficiency of the lamp may be increased from 50 per cent to 100 per cent, depending upon the type of reflector used. Either reason by itself appears sufficient to warrant the use of reflectors, the main requirements of which are as follows in order of importance:

1. Hiding lamp filament.
2. Correct distribution of light.
3. High efficiency.
4. Good appearance.
5. Economy.

"The principal types of reflectors are:

1. Prismatic clear glass.
2. Heavy density opal glass.
3. Medium density opal glass.
4. Light density opal glass.

"Prismatic clear glass reflectors are the most efficient, as with them it is possible to redirect the light in any direction desired, which permits of accurately meeting each lighting requirement. Their first cost is comparatively high, but is quite often justified where efficiency is of first consideration.

"Opal reflectors vary in efficiency, the heavy density being the most efficient and productive of the best light control.

"The following table shows the efficiency that may be expected from these various types of reflectors:

TABLE I—EFFICIENCY OF VARIOUS TYPES OF LIGHTING UNITS

Equipment	Foot candles per watt per sq. ft.	Watts per candle
Bare carbon lamp	0.44	3.75
Bare Mazda lamp	1.43	1.16
Light density opal reflector with Mazda lamp	2.22	....
Medium density opal reflector with Mazda lamp	2.60	....
Heavy density opal reflector with Mazda lamp.	3.16	....
Prismatic clear reflector with Mazda lamp	3.20	...."

Discussion.—In the matter of air brake hose the statement of the committee to the effect that the desirable feature of hose, namely, that of the resistance to oil, was emphasized. It was stated that it was a practical impossibility to avoid the presence of oil in the air system where motor-driven pumps are used, and that there was no specification that would provide a hose which was resistant to the action that followed. It was found that the best means of securing a hose that would give satisfactory service was to buy by brand, using one that gave the best results. This had been the practice on one large system for a number of years, and though the cost of hose had been high, it seemed at present to be the most satisfactory solution of the difficulty.

The detail of the report that received the greatest amount of attention was that relating to car lighting. In it the electric light was the only thing considered, and it was repeated several times that it had been found that the high wattage lamp was much more economical than the low. While photometric tests showed that the distribution of the light was fully as good with a few high wattage lamps as with a greater number of low ones.

In this distribution of the light the color of the side walls and the head lining has a great influence on the efficiency of the light. The case of the Interborough and the Brooklyn Rapid Transit railroads was cited as an example of what can be accomplished. The Interborough cars that were built several years ago were green up to the advertising line, and a light buff above it. The cars are 50 ft. long, and are lighted with 56-watt lamps on six circuits. In the case of the Interborough cars it is the present intention to have them white from the top of the seat backs upward. But, if they cannot be kept clean down as low as that, they will be white from the tops of the windows up. Elaborate photometric tests have been made, extending over several months, and it has been found that these cars can be lighted on three circuits of 56-watt lamps, and these cars are 67 ft. long and 1 ft. wider than the Interborough. The lamps are to be shaded with the Soudan globe.

As for the arrangement of the lamps, it was thought to be difficult to have a standard arrangement, but it seemed to many as though a standard would be worth while.

Another point suggested was the use of indirect lighting with which experiments are being made. It has been found that the system makes it possible to reduce the number of lamps, which reduces the power consumption and at the same time possesses the great advantage of keeping the direct rays of the light out of the eyes of the passengers.

There are indications that in some places the civic betterment societies are planning a regular campaign against the railways in the matter of better car lighting, and it was suggested that it would be advisable to forestall any action of this sort by the railways taking the matter up on their own initiative and doing all that is possible beforehand instead of being forced into it by outside action.

Among other suggestions leading to the better lighting of cars without extra expense was the use of frosted back globes, while for general economy it was recognized that the Mazda lamp was much superior to the carbon filament.

As an item contributing to a lessening of the expense of maintenance, the use of holders of larger diameter for globes and reflectors was suggested. It had been found on one road that where holders of 2¾ in. diameter had been substituted for those of 2¼ in. a considerable reduction of maintenance expenses had followed.

WAY MATTERS

The report gives a comprehensive statement of the present condition of track matters, and shows how the experience of street railways has led to the development of a roadbed that is near of kin to that used on steam railways, especially in the matter of the use of ballast. Many city roads are, however, still constructed with the ties resting directly on the subgrade. But in these cases careful attention is paid to proper drainage. A table is given of the bearing value of various soils taken from the report of the 1914 convention of the American Concrete Institute. It is as follows:

Material	Safe load in tons per sq. ft.
Quick sands and wet soils	0.1 to 1.0
Dry earth according to depth below surface	1.0 to 3.0
Moderately dry clay, confined	2.0 to 4.0
Dry, stiff clay	4.0 to 6.0
Sand, confined	2.0 to 6.0
Sand, compact and cemented	4.0 to 8.0
Gravel, cemented	8.0 to 12.0
Rock	25.0 to 200.0

As to ballast materials they vary about as they do on steam roads, and include crushed stone, gravel, cinders, slag and sand with a preference for crushed stone, which is also most extensively used.

There is one statement that differs somewhat from the published reports on the subject of rail and track deflection of steam railways. It is that neither headway nor speed has much influence on foundation excepting that where joints are poor or corrugation is present in rails the speed undoubtedly adds to the damage resulting from such conditions. Experiments with a deflectometer in Chicago show that there was no appreciable difference in deflection under car load whether the speed was constant, accelerated or retarded (Second Annual Report, Board of Supervising Engineers, Chicago Traction, 1909, page 184). The report definitely states that "only the actual weight of the car seemed to affect deflection and no wave motion in rail existed for no deflection could be discovered except when the car was actually over the point of reading."

In considering the subject of alloy steel rails, the data given were almost entirely those obtained from the steam railways. At the outset attention was called to the fact that the tonnage of alloy steel being rolled into rails of all sections has been declining for the last three years. The table on the following page shows the tonnage produced of the various kinds of steel rails in recent years and the total for each year.

TONNAGE OF STEEL RAILS ROLLED

Year	Alloys of— Titanium	Manganese copper nickel	Total alloy	Electric	Total open-hearth	Total Bessemer	Total tons
1897...	.....	.....	.....	.....	500	1,644,520	1,647,982
1906...	.....	.....	.....	.....	186,413	3,791,459	3,977,887
1909...	35,945	13,450	49,395	.....	1,256,674	1,767,171	3,023,845
1910...	256,759	565	257,324	.....	1,751,359	1,884,442	3,636,031
1911...	152,990	999	153,989	462	1,676,923	1,053,420	2,822,790
1912...	141,773	7,494	149,267	3,455	2,105,144	1,099,926	3,327,915
1913...	47,655	11,864	59,519	2,436	2,527,710	817,591	3,502,780

The following table gives the production by processes of alloy-treated steel rails since 1903, in gross tons:

	Open-hearth and electric	Bessemer	Total
Total for 1909	13,696	35,699	49,395
Total for 1910	27,389	229,935	257,324
Total for 1911	38,539	115,450	153,989
Total for 1912	40,393	108,874	149,267
Total for 1913	33,567	25,952	59,519

These figures taken from the published records of the American Iron & Steel Institute show that the production of Bessemer steel rails has been steadily declining, while the production of open-hearth steel rails has been increasing at a nearly corresponding rate. The first separation of production records to show the amounts of alloyed steel made into rails was in 1909, and since 1910 the tonnage produced has been declining. A plat of these figures is given in the report to illustrate graphically the point that as use of open-hearth rails has increased the tonnage of alloyed steel rolled into rails has decreased until it is now quite insignificant as compared with the total tonnage of rails rolled. This condition is no doubt a natural one, for with the cost of open-hearth rails $2 per ton more than the cost of Bessemer, purchasers probably have some reluctance over having the extra prices for alloyed steels added to the already increased rate for the open-hearth. In other words, the indisputable tendency is toward the increasing use of open-hearth rails, which, from the records, indicate greater wearing qualities than Bessemer rails, and as open-hearth rails cost seven per cent more than Bessemer rails, purchasers are loath to add to this the extra cost demanded for the alloyed steel. In the case of open-hearth steel made with the usual addition of 0.1 per cent metallic titanium, the cost is roughly 12 per cent more than the cost of plain Bessemer steel, while with manganese steel at $80 per ton, the cost is 186 per cent more. The first cost of alloyed steel rails therefore may be not only prohibitive in some instances, but in others so high as to render return on the investment extremely slow, especially when a large sum is involved. These matters have doubtless militated against the production of alloyed steel rails and purchasers have contended themselves with the adoption of open-hearth steel on the reasoning that for 7 per cent greater first cost, 50 per cent longer life for the rails might follow.

Under special conditions of quick wearing track, sufficient benefits may ensue to warrant the adoption of an alloy steel rail, and for such purposes particularly the demand for alloy rails seems to emanate. The question then of what alloy to use is an important one, and eliminating matters of cost entirely the purchaser has ferro-titanium, manganese, nickel, high silicon and electric steel to choose from. The fact that rail sections are of an intricate and unbalanced character, the girder and high T-rails being especially so, is indeed unfortunate; for these odd shapes quite preclude opportunity for successful heat treatment—a process for increasing strength and wearing qualities in which direction much progress has been made in recent years on such articles as axles, rail joints, bolts and sundry automobile parts. However, some attention has been given to the heat treatment of rails, and while no results have been published, it is within reason to expect that a satisfactory method will eventually be found for overcoming the difficulties encountered.

This review is therefore confined to the experience with those alloy steels mentioned, all of which are more or less readily obtainable in any section for street and interurban railway work.

It must be appreciated that experience with alloyed steels is dependent on a number of factors in addition to the metal itself. The mere fact of adding 0.1 per cent of metallic titanium or 13 per cent of manganese, for example, to the steel will not in itself effect a panacea for the ills to which track and rails are subject, and reported results of breakage and wearing qualities therefore are inclined to show divergent results in many cases, and even average results for any particular kind of steel may be greatly exaggerated. The best tests are those of individual character where different kinds of steel are laid in line on the same type of roadway and subjected to equal conditions and maintenance. Results from such experimental track afford good comparison, but the tendency even then is to often measure the rail wear by the eye rather than by the accurate, though delicate instruments, so that misleading figures may readily follow.

The only American records published showing the results of rail failures, and in some instances wearing qualities, are those of the American Railway Engineering Association. But very little accurate data were obtained by the committee as to the efficiency of alloy rails for street railway service, other than that the wear of manganese steel rails was about one-fifth that of ordinary steel rails.

Notwithstanding this paucity of data the statement is emphasized that girder and high T-rails, as well as standard sections, can be easily rolled from the following special steels possessing the general characteristics mentioned:

Kind	Steel containing	General properties anticipated
Titanium	.....0.1 per cent metallic titanium.	Less segregation, cleaner metal, hence longer life.
Nickel	.....3.5 per cent nickel.....	Increased life.
Nickel chrome	..Containing varying percentages—nickel and chromium.	Increased life by being tough and hard.
Manganese	....About 12 per cent manganese.	Very tough and hard, cannot be easily cut or drilled, wears slowly.
Electric	.....Made in electric furnace....	Very clean steel, free from impurities, thus adding life.
High silicon	....About 0.35 per cent silicon...	Increased life. Much used in England.

Discussion.—The discussion was devoted almost exclusively to the movement of rails in urban tracks and in the methods of paving.

HEAVY ELECTRIC TRACTION

This report dealt for the most part with overhead clearances, which were placd as follows, for:

Trainman with lantern	25 ft. 0 in.
Trainman without lantern	24 ft. 0 in.
Without trainman on cars	18 ft. 0 in.
High voltage wires	16 ft. 10 in.
Minimum for 600 volt overhead contact	16 ft. 0 in.

As third rail clearances it was recommended that the subject be continued for another year. The same recommendation was made in the matter of electric locomotives, because of the number of varied designs now in process of development.

No Discussion.

ELECTION OF OFFICERS

At the annual election the following officers were elected in the engineering section: President, L. P. Crecilius, electrical engineer, Cleveland Ry. Co.; first vice-president, John Lindall, superintendent rolling stock and shops. Boston Elevated; second vice-president, B. F. Wood, chief engineer, United Gas & Electric Engineering Corporation of New York; third vice-president, F. R. Phillips, superintendent equipment, East Pittsburgh Railway; secretary and treasurer, E. B. Burritt; executive committee, J. P. Barnes, general manager, Syracuse and Suburban; G. W. Palmer, electrical engineer, Bay State; H. F. Merker, engineer maintenance of way, East St. Louis & Suburban; W. G. Gore, superintendent equipment, Brooklyn Rapid Transit.

VENEZUELAN IMPORTS OF RAILWAY MATERIAL.—In 1912 Venezuela imported railroad material having a total value of $164,000, $23,000 of this representing supplies from Germany.

Mechanical Stokers for Locomotives*

Essential Features to Be Considered in Designing Machines for This Work; Increase in Tonnage Obtainable

By Clement F. Street†

The firing of a locomotive with a shovel is the most crude operation being performed on our railways to-day, as is shown by the almost continuous series of experiments which have been carried on during the past twenty years, with a view of producing a successful locomotive stoker. When these experiments were first begun, it was with the idea that the stoker would be, primarily, a fuel-saving device, and its labor-saving features were considered as secondary. With the advent of the large locomotive this view has changed, as the limit of the size of the locomotives which could be built has been fixed by the capacity of a man to shovel coal. With the advent of the successful stoker, this limit has been removed, and it is now possible to build locomotives to burn any quantity of coal which may be desirable. In addition to this, the use of the stoker has increased the capacity of many locomotives already in service. The question of capacity is to-day the first consideration, and any question of fuel saving, although important, has become secondary.

Locomotive stokers in substantial numbers, about 850, are now in regular daily successful operation and are considered an essential part of the equipment of the largest locomotives being built. The Baltimore & Ohio has just placed in service 30, and the Chicago, Burlington & Quincy 25 locomotives of the 2-10-2 type, which have a tractive effort of about 71,000 lb. and which would never have been built had it not been known that a stoker could be secured which would fire them properly. The Norfolk & Western has 105 Mallet locomotives fitted with stokers, which could not be shovel-fired in the service in which they are used.

It is not at all a difficult matter to fire a locomotive with a stoker and it does not seem to be generally known that practically every stoker ever applied to a locomotive has fired it and done a very good job. The actual firing of a locomotive is only the beginning, and a very small beginning, of the solution of the problem of producing a successful stoker. A locomotive stoker of the scatter type in order to be a successful and a commercial machine must do, if not all, at least most of the following:

It must not break down.

It must do at least 90 per cent of all manual labor in taking coal from the tender and distributing it over the grate.

It must distribute coal evenly over the grate and provide means for firing heavy on any one section or zone in case the locomotive does not burn an even fire.

It must be constructed so that the fireman can at any time inspect the fire, rake it, and do shovel-firing without shutting off the stoker.

It must have several definite and marked rates of feed, have a capacity in excess of the maximum requirements, and feed coal continuously at any definite rate at which it is set and maintain that rate regardless of variations in steam pressure or grade amount, or condition of the coal fed to it.

It must be constructed so that feeding to it bolts, spikes, rocks and any other foreign matter which may be in the coal will not result in a breakage and so that such matter or articles can be removed without taking the machine apart, in case they cause a clog.

It must have all parts easy of access for making inspection, repairs and lubrication.

The cost of inspection and running repairs must not be in excess of 75 cents per 100 locomotive miles.

It must be so simple in construction that the average fireman can understand the function of each part and be able to operate it successfully, after having received instructions during only one or two trips over a division.

It must have the opening through which coal is admitted covered with a screen which will reduce to a minimum the liability of the admission of foreign matter which will cause clogs.

It must handle wet coal.

It must keep a locomotive hot under all conditions with a lower grade of coal than is required for shovel-firing.

The first requirement of a successful stoker is reliability. The machine must not break down, and any machine which is liable to frequent break-downs is foredoomed to failure. The fire carried by a stoker is much lighter than with shovel-firing; the exhaust nozzle is larger for a stoker-fired locomotive, and a fireman who has been trained to stoker-firing, finds it very difficult indeed to take up hand-firing, or, if he has formerly been hand-firing, go back to it. Consequently, it is of vital importance that a stoker be reliable, and not subject to failure.

Very few locomotives will burn a fire evenly all over the grate and a successful stoker must, therefore, be constructed to meet this characteristic and feed continuously and steadily a larger proportion of the coal to that section where it is burning heavy than to the section where it is burning light.

A successful stoker fireman will at all times know just what condition his fire is in and he can do this only by making frequent inspections of it. If it is so hot he cannot see it he will put the hook in and feel it. With the best of machines and under the most favorable conditions it may be found that a few shovels of coal added at a certain place will help out materially, and conditions are liable at any time to arise which make this absolutely essential for securing the best operation. In order to secure the best results the fire should be thoroughly inspected at least every thirty minutes, and the stoker should be constructed so that this can be done without interfering in any way with its operation and certainly without shutting it down.

The driving engine of a stoker, under normal conditions, is working at not more than four or five horse power. A piece of slate, or large lump of coal, or some foreign substance entering the machine, will immediately double or treble the load on the stoker engine. There must be some sort of an automatic governor on this engine, which will take care of these wide fluctuations in the load. Without this, a fireman will never know the rate at which coal is entering the firebox, and is working entirely in the dark.

One of the things a stoker designer has to figure on is the fact that it is impossible to keep foreign matter out of a stoker. The properly designed machine should be able to withstand without breakage the feeding to it of an obstruction which will stop it instantly. In order to do this, all of the different parts of the machine must have more strength than the engine, and the only result of a clog of this nature must be that the machine will stop.

One of the most important characteristics of a stoker is that it shall be easy to inspect and lubricate. A machine should be built so that an inspector can start it up, inspect all its working parts and see that it is in operating condition, in not more than ten to fifteen minutes.

Some of the coal being used in stokers contains so much dirt that when it becomes wet it forms a sticky paste, which will not run and which plasters onto anything it comes in contact with, and forms a hard cake as it dries. This is about the hardest proposition the stoker has to contend with, but the successful machine *must* handle it.

One of the first things to be discovered in experimenting with the stoker, was the fact that it was possible, with it, to burn a

---

*Abstract of a paper read before the Western Railway Club, October 20, 1914.

†Vice-president, Locomotive Stoker Company, New York.

poorer grade of coal than could be used with shovel-firing. One of the problems which the railways are always up against is that of poor coal, and a properly designed locomotive stoker will eliminate practically all complaints of poor coal.

With a scatter type of stoker, the tendency is for a considerable proportion of the dust and finer particles to be carried out of the stack by the heavy draft, and in order to secure the best results from this type of machine, some provision should be made to prevent this. One of the methods, which has been successfully employed is to provide a screen, which takes out the dust and finer particles, and deposits them across the back end of the bridge. This is considered a very important feature of a stoker of this type, and while a machine not having it will undoubtedly fire locomotives successfully, it will certainly not give as good fuel economy as a machine having this feature. If, therefore, the best results as to fuel economy are to be obtained something of this nature must be provided.

It is very evident that in the near future all locomotives in main line train service will be fitted with stokers, but the question to-day is where to begin, and to which class should they be applied first. It can be confidently stated that, under average conditions, any locomotive, freight or passenger, which has a maximum tractive effort of 50,000 lb. or over, should be fitted with a stoker and any freight locomotive, which burns 4,000 lb. or over, of coal per hour, continuously, for periods of one hour or over, should be fitted with a stoker. In passenger service there are very few locomotives of over 50,000 lb. tractive effort which are not fitted with stokers, and they all should be, if it is expected to work them to their full capacity, as it is out of the question to do so with shovel-firing. A fireman in passenger service, however, can shovel a much larger amount of coal per hour than he can in freight service, because the length of time which he must work is so much shorter that he is not liable to become exhausted before reaching the end of a division.

The primary object of applying a stoker to a locomotive is to enable the operation of that locomotive to its full capacity at all times and under all conditions, and this object is being attained wherever stokers have been applied. On one division of a railroad, with Mikado type locomotives having a tractive effort of 54,000 lb., the tonnage rating, without superheaters, and with shovel-firing, was 4,750 tons. Superheaters were applied and the rating was made 5,000 tons. Stokers were applied and the rating was made 5,250 tons; then 5,500 tons, 5,750 tons, and it is now 6,000 tons. At the same time the rating of the shovel-fired superheater locomotives, was pushed up to 5,500 tons. It was found, however, that it was not practical to run shovel-fired and stoker-fired locomotives on the same division, as even with the less tonnage, the speed of the former was so much less than that of the latter that they could not keep out of the way, were continually delaying traffic, and now all trains on this division are being hauled by stoker-fired locomotives.

On another division of the same road, before stokers were applied, these locomotives were hauling 5,000 adjusted tons. After the stokers were applied, this tonnage was gradually increased to 6,500 tons, and at one point on the division, with a river grade, they are hauling 85 to 115 all-steel, 70-ton coal cars, giving a tonnage of from 8,600 to 8,900 tons. At another point on this same road, fast freight trains are being run over two divisions—a total distance of 187 miles—with the same engine crew. Before the stokers were applied, the firemen were always changed at an intermediate point, and sometimes the enginemen.

The reason that the increase in tonnage is possible is from the fact that the fireman can secure and maintain the maximum steam pressure on the boiler at all times and under all conditions. It is not an uncommon occurrence, on heavy freight trains hauled by the locomotives referred to above, for the engineman to work his cylinders at full stroke, with the throttle wide open, both injectors on and maintain a speed of 18 miles an hour. There is no difficulty in maintaining full steam pressure under these conditions and at this speed.

Another advantage which follows the use of stokers is in that the time required for cleaning fires, both at terminals and on the road, is very much reduced. A stoker fire clinkers much less than a shovel fire, and statistics show, as a result of this, that it requires less than one-half as much time to clean a stoker fire as it does a shovel fire.

The actual results show very clearly that, under average conditions, with an equal grade of coal, a stoker-fired locomotive will not burn any more coal than a shovel-fired, in proportion to the amount of work done. It is, however, an invariable rule, that stoker-fired locomotives are worked harder than the shovel-fired locomotives, and are also given a poorer grade of coal. On many roads using stokers, they are giving the locomotives fitted with them a grade of coal which is so poor that it cannot be used successfully for shovel-firing at all.

This same thing applies to the amount of water evaporated per pound of coal. The boiler of a stoker-fired locomotive is, as a rule, not worked at as economical a point as one which is shovel-fired, and the rate of evaporation is, therefore, not so good. I regret very much to have to say that there are no absolute figures to demonstrate this. On all roads which are using any appreciable number of stokers, the question of fuel saving has been given very little, if any, consideration, as the advantage to be gained by the increased tonnage and increased speeds is so great that any questions of fuel economy sink into insignificance in comparison with it.

It has been stated that one of the objections to a stoker on a locomotive is that it makes it too easy to waste steam through the safety valve. My reply to this is that a fireman who will waste steam through the safety valve with a stoker will do the same thing with a shovel.

In order to secure the best results from stoker-firing a locomotive with bituminous coal, the physical characteristics are more important than the chemical analysis, and better results are often secured from coal of inferior quality, in proper physical form, than from that of a better grade, in improper size. The ideal coal for stoker-firing is secured by passing run of mine coal over a screen with about two-and-one-half inch square openings. When coal of this character is spread over the grate by means of the scatter type stoker, it gives a uniform, even fire, and produces very rapid combustion. If coal is to be burned at the rate of from 100 to 150 pounds of coal per square foot of grate per hour, it is vital that it be very nearly of a uniform size, as any lumps of 3, 4, 5 or 6 inches applied to a stoker fire will result in uneven burning of that fire, and in unsatisfactory results.

In conclusion I wish to emphasize the importance of at all times maintaining a large view of the subject and not allowing any detail to acquire undue importance. Each of the points touched on has its own importance, but they are all secondary to the one large reason for applying a stoker to a locomotive.

A railroad is built for the purpose of earning money, which must be earned by its locomotives. The only reason for applying a stoker to a locomotive is to enable it to earn more money. Railroads no longer control the amount of compensation which they can receive for service performed. They are continually confronted by increased cost of operation, increased taxes and legislative requirements; in order to live they must increase the earning power of their locomotives.

Statistics show that the application of a stoker to many of the large locomotives now in use will result in increasing the earning power of those locomotives from 10 to 20 per cent. The use of the stoker makes it possible to build new locomotives having from 20 to 30 per cent more earning power than those commonly in use at the present time.

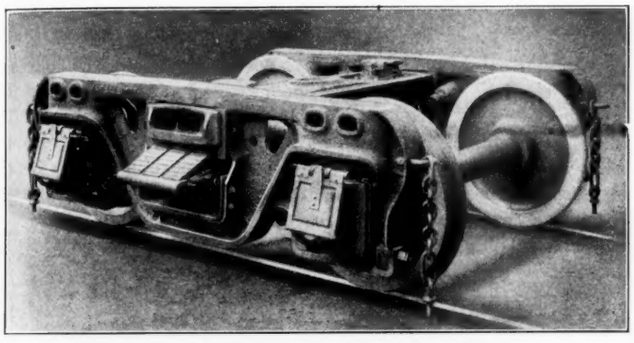
DISCUSSION

It was brought out in the discussion that there has been about $1,250,000 spent for stokers up to the present. The use of the stoker, it was stated, has lessened the maintenance cost for fireboxes and tubes. The Burlington is now using coal for stoker-

fired locomotives, which costs about 75 per cent as much as that used for hand-fired engines and has 90 per cent of the heating value of the latter. It was also stated that special men are necessary for proper inspection and repairs to the stokers and that firemen must watch the fire carefully in order to obtain the best results. A stoker will do much better work than two firemen. No trouble has been experienced from plugged tubes when a brick arch is used and by the use of the stoker a greater locomotive capacity is obtained. The use of the scoop was recommended in order to fill holes in the fire. One road has a record of 3,000,000 locomotive miles with stoker failures averaging one in 54,000 miles. It was also claimed that stoker-fired locomotives will maintain a more uniform speed over a division.

IMPROVED DESIGNS OF ENGINE AND TENDER TRUCKS

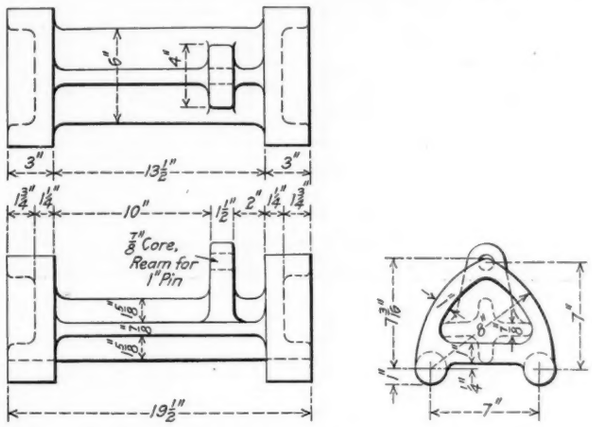
The change in wheel arrangement, together with the increased size and weight of the modern locomotive, has imposed a duty upon the leading truck of the prevailing design out of all proportion to its guiding capacity. As a consequence the work



Economy Tender Truck

which should devolve upon the truck consistent with the load carried at the centerpin has been, to a considerable extent, taken up by the leading drivers, resulting in lack of stability on tangents and excessive wear of the flanges of leading driving wheel tires.

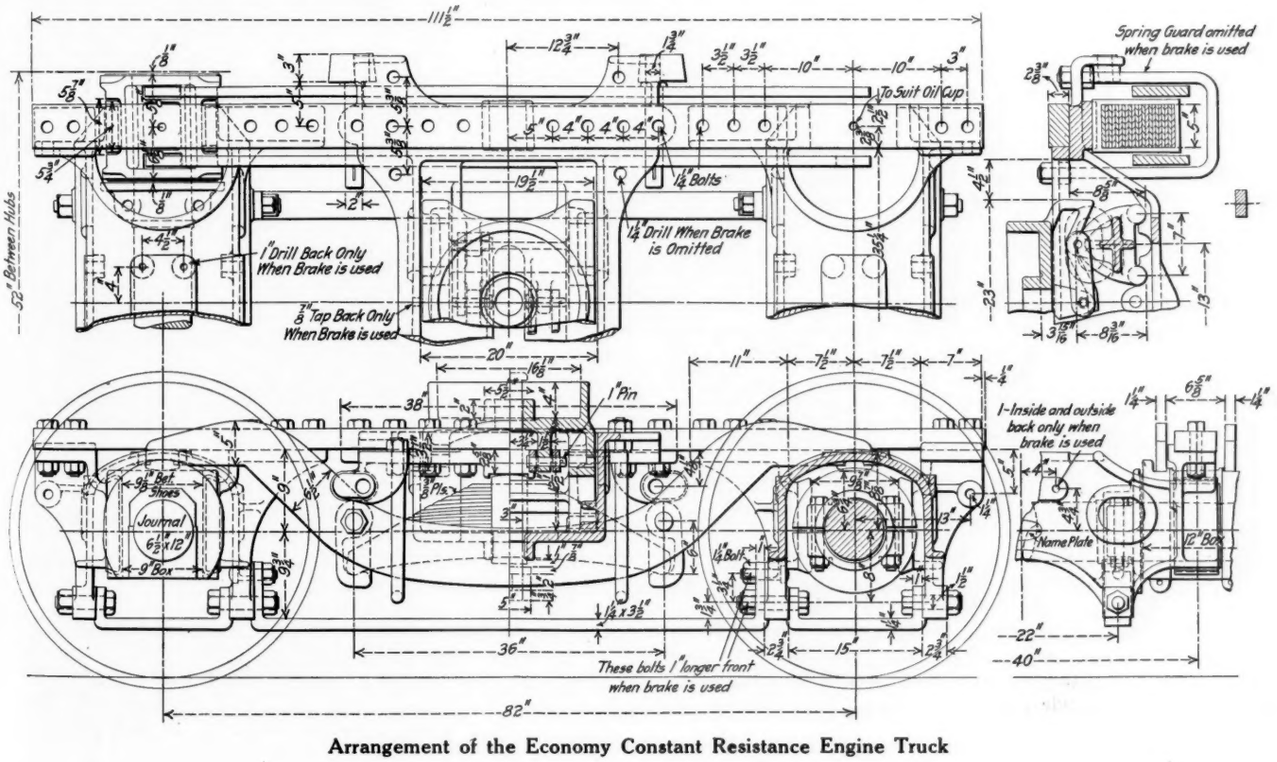
These conditions have led to the development of a lateral motion bolster device for locomotive trucks which, it is claimed, will meet these exacting requirements more fully than the three point link suspension which heretofore has been almost universally used. In principle it provides a constant resistance regardless of the lateral displacement of the bolster instead of a low initial resistance increasing with the lateral displacement, as



Rocker Used in the Engine Truck

is obtained with the three point suspension links. Variations, such as high initial resistance, with a constant resistance following a predetermined bolster movement, can be obtained by slight modification of the surfaces in contact. One of the illustrations shows the heart shaped rocker in detail. The swing bolster bears directly on these rockers which are connected to it by links to insure their remaining in the proper position.

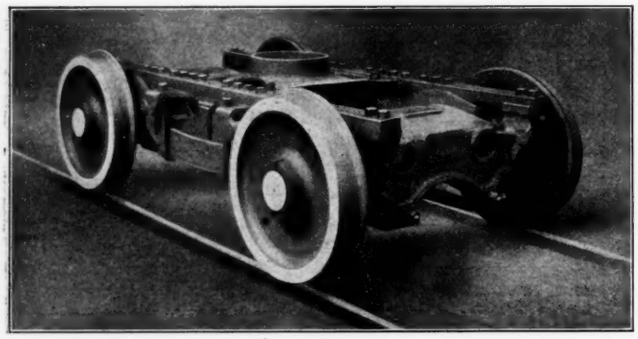
Service results with this truck show a marked reduction in the flange wear on leading drivers, a steadying action while running on straight track, an absence of jerky motion on curves and withal a better riding engine under all track conditions. This bolster arrangement, on account of its doing more work in guid-



Arrangement of the Economy Constant Resistance Engine Truck

ing the engine, requires a high duty truck frame. The design here shown eliminates the separate, bolted-on pedestals, combining the four pedestals at each end of the truck in a single cast steel transom with renewable shoes. The use of axle collars having been found desirable, this arrangement enables the cellars to be packed without removing the pedestal tie bars.

The aim in the design of the Economy tender truck, illustrations of which are also included, was to secure an easy riding truck having flexibility combined with the ability to remain square, in conjunction with either a lateral motion or rigid centering arrangement. Easy riding qualities have been obtained by the use of the pedestal type of frame with coil springs resting on an equalizer centrally located over each box, in combination with elliptic bolster springs. The coil springs arranged in the manner shown will accommodate any axle load that it is possible to utilize, with the idea of always providing surplus capacity to obviate breakage.



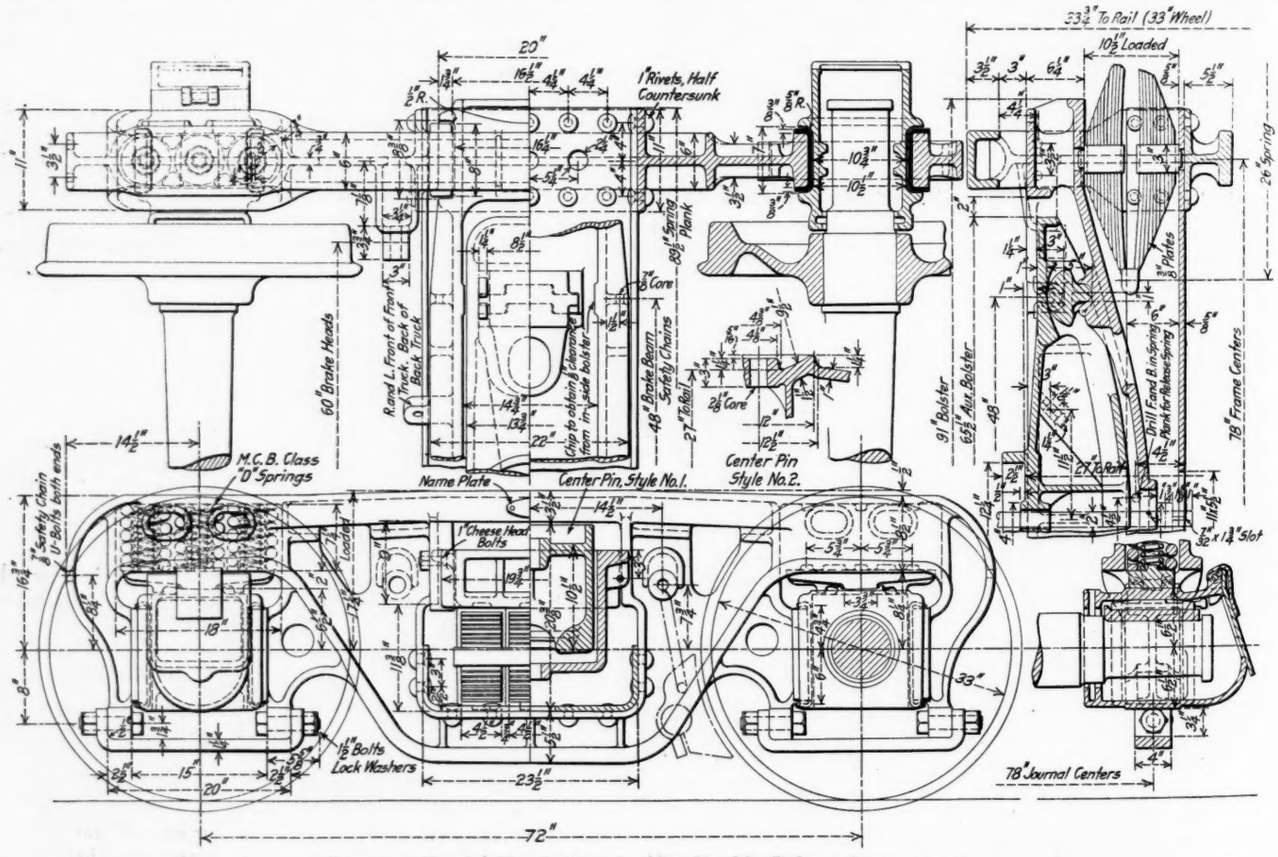
The Economy Engine Truck is Designed to Provide Constant Resistance Regardless of the Lateral Displacement of the Bolster

The spring plank arrangement provides for the flexibility that ordinarily obtains with the arch bar truck, permitting the truck to accommodate itself to uneven track conditions without causing undue stresses upon any of the coil springs, or unequal bearing pressures. The riveted connections between the truck frame and the spring plank are of such ample proportions, and the spring plank of so great a width as to insure the truck remaining square.

The bolster arrangement to provide for lateral motion consists of an auxiliary bolster located within the main bolster and resting upon three point rockers. The rocker bearing surfaces can be so arranged as to provide for a resistance curve identical with that obtained with the use of two point offset hangers. This arrangement eliminates the use of cross transoms. The curve of resistance can be changed by changing the contour of the bearing surfaces. If lateral motion arrangement is not desired a plain bolster can be substituted for the swing motion bolster without any alteration. It will be noted that few parts are used in providing for a pedestal type truck having a swing motion bolster. The side frames are designed to give ample lateral as well as vertical strength, and brake hanger bosses are arranged to use U shaped hangers, without offset.

Both these trucks are the product of the Economy Devices Corporation, 30 Church street, New York.

ADVENTURES OF A FRENCH RAILWAY CARRIAGE—The parlor car courteously placed by the French government at the disposal of Baron von Schoen, the German Ambassador, when he left Paris on August 3, has found its way back to France, after various vicissitudes. It reached Berlin on the morning of Wednesday, August 5, where it was seized by the authorities. After a day's arrest it was released, and sent to Munich, which it reached on the following Friday morning. Thence it was sent on to Lindau, where it was seized for the second time, and for a second time set free. From Lindau it reached Neufchatel by way of Constance, and finally, somewhat wayworn, it came to rest at a siding of the Gare de Lyon at Paris.



Economy Tender Truck, Showing the Double Bolster Arrangement

Maintenance of Way Section

Difficulty is often experienced in securing genuine wrought iron pipe, as mentioned in the committee report on Water Pipe of the Bridge & Building Association, abstracted elsewhere in this issue. In this connection it may interest users of pipe to know that 87½ per cent of all iron and steel pipe manufactured in this country is steel and only 12½ per cent wrought iron, as shown by a recent statistical bulletin of the American Iron & Steel Institute. These figures have changed from 68½ and 31½, respectively, since 1905, and it is only 27 years since the first steel pipe was made. Undoubtedly a very large part of this steel pipe is used under conditions much less severe than are common in railway work, which would render the superior qualities of wrought iron less important. But, this rapid growth and present preponderance of steel emphasize two things; first, the desirability of investigating each installation to see whether the more expensive material, wrought iron, is justified; and second, if it is found to be justified, the necessity of specifying the material very carefully and then taking steps to see that the desired quality is furnished.

Wrought Iron and Steel Pipe

Deformed bars are used as the reinforcing material in reinforced concrete structures on 17 of the 25 important roads reporting on this point to a committee of the American Railway Bridge & Building Association. Of these 17 roads, 8 did not use any other form of reinforcement. In contrast to this showing for the deformed bars, only 8 roads allow the use of plain bars and only 1 of these 8 uses them exclusively. Further, a comparison of the values assumed for the adhesion of steel and concrete in designing the structures shows a marked difference between plain and deformed bars in favor of the latter. The A. R. E. A. manual of recommended practice gives the bond strength of a plain bar as 80 lb. per sq. in. and of a deformed bar as 100 to 150 lb. per sq. in., but the difference as shown by the tabulation of actual practice is even greater than this, for the plain rods are credited with a strength of only 50 to 80 lb. per sq. in., with the average about midway between those values, while deformed bars range all the way from 50 to 200 lb. per sq. in., with the average between 100 and 150. If recent tests, referred to in the committee's report, which show that plain bars develop a bond strength fully as great as the special shapes, are to be accepted, these assumptions in favor of deformed bars should be carefully considered with a view to revision, even though other considerations, such as resistance to vibration, may warrant the continued use of deformed bars.

Bond Strength of Reinforcing Steel

The designs of foundations for bridges, buildings, tanks, walls, etc., are always subject to modification in construction on account of unforeseen conditions affecting the work. Even when comparatively accurate information as to the nature of the material, the amount and level of the ground water, etc., has been secured before the design is made, expediency in handling the work, or limitation of available construction plant, may make advisable some changes in the plans. Ordinarily, little effort is made to record accurately the changes that are made and after the completion of the work the original plans are filed. This lack of an accurate record of the details of a structure as actually built is often responsible for unnecessary expenditures in later years when improvements or alterations are required, or when adjacent work is under way. Also, in many cases of accidents involving structures such records of construction would be very valuable in fixing the responsibility or determining the cause. A noteworthy example of practice in direct contrast to the common method was furnished recently by a large eastern trunk line in the construction of a considerable amount of concrete trestle. A record sheet was made up for each of the nearly 300 piers. As practically all of these had been built to one standard plan it was possible to reproduce the same drawing of plan, side and end elevations for all the piers of one design, filling in on the individual sheets the data referring to that particular pier. This information included the elevations of the top and bottom of the foundation masonry, of the heads and points of the supporting piles, and approximate depth that the piles sank under the weight of the hammer, the number of blows required for the last foot of penetration, and a complete record of the date of beginning and ending of each portion of the work. In addition, the names of the inspectors on the work and special notations covering any defects that appeared during construction and the method of correcting them were added. The inspectors kept the notes for these records in connection with their other duties, and a draftsman in the field construction office made the record sheet. Handling the matter in this way, the expense of preparing the record was trivial, and one occasion to use the data thus made available would more than compensate for the time and trouble of keeping it.

Accurate Records of Construction Work

Railway engineers have been familiar in a general way with the use of manganese in frog, crossing and other special track construction for several years. The first cost of manganese is considerably higher than that of standard open hearth or Bessemer construction, and this has naturally been a serious detriment to its general adoption. This objection has led to an endeavor on the part of the manufacturers to reduce the amount of manganese to the minimum consistent with the service required in order to reduce the cost. The purchasing agents of the railroads, and in most cases the engineers as well, have had no definite knowledge of the principles of design of manganese track work or of the problems connected with its manufacture. These conditions have gradually led to the partial demoralization of the manganese industry. Relying on the lack of standards on the part of the roads, some few manufacturers have reduced the amount of metal in their designs below the safe limit in order to underbid their competitors and secure the business. In most instances the railroad men have had to rely on the statements of the manufacturers, and as a result a low first cost has been the main consideration. This has forced other manufacturers to reduce the amount of manganese in their designs in order to secure any of this business, and has led to many failures of manganese track work in the past few years which have tended to prejudice engineers against its use. In an attempt to check this tendency several manufacturers of manganese track work, controlling over 80 per cent of the output, have recently organized the Manganese Track Society for the purpose of standardizing manganese track construction. This organization has already prepared standard designs for solid and rail-bound frogs and for solid crossings and is now engaged on other track work units. These standards have been submitted to the American Railway Engineering Association for investigation and approval and are now being considered by a committee of that association. Stand-

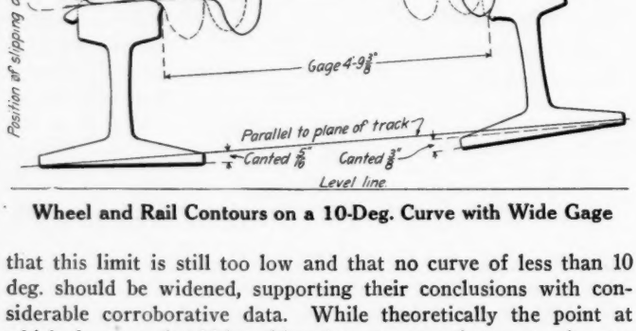
The Standardization of Manganese Track Construction

ards prepared in this way by the manufacturers and the users should be practical from the standpoint of both, and once adopted they should provide standards on which the roads can secure bids knowing that the material obtained will be in accordance with the best knowledge available. Manganese track construction is of direct economy in numerous forms of track work and this action of the manufacturers to improve and standardize their product deserves commendation.

ACCURATE MAINTENANCE OF GAGE

THE maintenance of track to accurate gage on tangents and curves is not receiving the attention from track men today that its importance deserves. While no one will intentionally allow rails to spread until there is danger of the wheels dropping onto the ties, small inequalities are not considered of sufficient importance to demand regaging the track and they are permitted to increase until considerable work is required to bring the track back to its proper condition.

This problem is of increasing importance on curves, and it is here that it is neglected to the greatest extent. In the first place, there is a wide divergence of opinion regarding the degree of curvature at which the gage should be widened. Practice in this regard is now passing through a transition, partly because of improvements in locomotive truck design providing greater flexibility, but mainly as a result of greater study of actual track conditions. Five or ten years ago it was considered good practice to begin widening the gage on curves of 4 deg. and over. Later practice has shown this to be unnecessary and the recommended practice of the American Railway Engineering Association now provides that curves of 8 deg. and under should be maintained to standard gage, while curves sharper than 8 deg. should be increased ⅛ in. for each 2 deg. or fraction thereof. Some believe



Wheel and Rail Contours on a 10-Deg. Curve with Wide Gage

that this limit is still too low and that no curve of less than 10 deg. should be widened, supporting their conclusions with considerable corroborative data. While theoretically the point at which the gage should be widened to accommodate a certain type of locomotive is capable of accurate determination, the conclusions reached by theoretical reasoning have not always been borne out in practice. Greater dependence should therefore be placed on the results which have been secured on several roads which have given this subject careful attention than on the various theoretical analyses.

The evil results of wide gage are evident in several ways. In the first place, while track in accurate gage tends to hold the trucks in their proper course, irregular or uniformly wide gage permits them to shift back and forth laterally, giving the effect of swinging or rough riding track. This has been shown strikingly by the track inspection instrument used in making periodic track inspections on the Pennsylvania Railroad, in which wide gage, with the resulting more or less pronounced lurch of the car, is indicated by the movement of a pendulum.

More important, however, is the influence of wide gage on derailments. Contrary to what might be expected, wide gage aids rather than prevents derailments. This is illustrated by an experience on the Santa Fe. Several years ago a number of new locomotives were distributed over several divisions. After a short time there were numerous complaints about the difficulty of keeping these locomotives on the track, especially on 10-deg. curves, on all divisions on which they were operated except one. Investigation showed that while the curves on all the other divisions had been laid with the increased width of gage required by the standards, the rail was laid on the one division to the standard gage of 4 ft. 8½ in. when screw spikes were inserted with the expectation that the gage would increase slightly under traffic. However, this had not occurred. Since the locomotives were passing over these curves without difficulty the curves on the other divisions were brought to this same gage, after which no further difficulty was encountered. The standard practice of this road now provides that no curves 10 deg. or under shall be widened. This seems reasonable when one considers that track laid to tight gage holds the wheels in their proper position, preventing their lateral motion and decreasing the liability to climb over the rail when striking it at a slight angle.

One phase of this problem frequently lost sight of is the increased destruction of material resulting from wide gage. The same lateral movement of the truck which gives the effect of rough riding track causes a wear on the rail and wheel flange whenever they come in contact which is more severe when the flange engages the rail at an angle. Especially on curves where rail wear is normally more severe it has been found that decreasing the extra gage allowance has had a marked effect in increasing the life of the rail. On one 10-deg. curve on the Santa Fe records showed that the life of rail was increased from 18 to 26 months by eliminating the additional width of gage. Aside from accelerating the grinding wear on the side of the gage head, wide gage contributes materially to the flowing of rail as shown by the accompanying sketch. As the wheels, and particularly the heavy engine drivers, are allowed to slide laterally over the top of the rail, they force the metal to the sides of the head, creating the lip commonly found. The effect of the false flange is also shown in this sketch which was made from actual wheel and rail contours taken on a 10-deg. curve and 1.85 per cent grade after the rail had been in service 12 months. In numerous instances where the rail has flowed badly this difficulty has been alleviated or removed by bringing the track to standard gage. This destruction of material is not confined to the rail alone. As the gage is widened the trucks are allowed more play and therefore deliver heavier lateral blows to the rail, which in turn are transmitted to the spikes and the tie, causing the wood fiber supporting the spike to crush and contributing materially to the spike killing of the tie.

NEW BOOKS

Handbook of Construction Plant. By Richard T. Dana, consulting engineer. Size 5 in. by 7 in., 702 pages, 312 illustrations. Bound in flexible leather. Published by the Myron C. Clark Publishing Company, Chicago. Price $5.

The author of this volume has set himself a difficult task in presenting complete data on the performance and cost of all types of construction plant. On account of the wide variety of equipment and devices required for special work many users of the book will undoubtedly discover shortcomings. The aim, however, is commendable and the information included will undoubtedly be of service to many contractors and engineers. The purchase prices of equipment quoted in the book are in general bona fide bids made to the author and often represent averages of many such bids. The fluctuation in the price of materials makes many of these figures subject to question, but for purposes of estimating, the accuracy is probably as great as necessary. The statements as to the capacity of plant have been carefully checked and a large part of the material contained in the book has been subject to daily use in the author's office for some time. In order to facilitate the securing of bids on material where more accurate prices are needed a list of dealers in construction plant is included in an appendix, and in most cases dealers' names are omitted through the text. The subjects are arranged alphabetically with a view to easy reference and, in addition, a very complete index is supplied.

Recent Developments in Track Construction*

A Review of the Increases in Loading of Track and the Improvements in Details of Its Construction

By Elmer T. Howson

It is frequently stated that steam railroad tracks are not sufficiently strong to carry the loads which are placed upon them with the proper factor of safety, and that the design of the track structure has not kept pace with the increase in these loads in recent years. While this is by no means the consensus of opinion, this subject is one of great importance at the present time, and the question of the relative strength of our present track construction is giving many railroad men cause for grave concern today.

INCREASE IN WHEEL LOADS AND SPEED

In discussing the present strength of the track, the first step is to determine the extent to which the service demanded of it has increased in recent years. The two most important factors affecting the stresses in the track are the weight of the trains and their speeds.

The weights of locomotives built in the past two or three years have not increased as much as in earlier periods, but this is due in very large measure to the fact that designers have been able to meet the demands for increased train loading on the part of the operating department by the adoption of the superheater, the brick arch, the mechanical stoker, and other important improvements. Developments of this nature cannot be expected to continue indefinitely, and it seems reasonable to expect that the weight of locomotives will soon increase again. The two most important developments in locomotive designing in the past year are the Atlantic type passenger engine of the Pennsylvania Railroad, weighing 240,000 lb., with 133,100 lb. on the drivers, or 66,500 lb. per axle, and the triplex type locomotive recently completed by the Baldwin Locomotive Works for the Erie, which weighs 853,050 lb. complete, with 24 drivers spaced 5 ft. 6 in. between axles and 61,900 lb. on each axle. The average weight, exclusive of tenders, of the locomotives in service in 1911 was reported by the Interstate Commerce Commission to be 150,800 lb., or 33 per cent heavier than in 1902. The average load on drivers for the more recent locomotives now ranges between 50,000 and 60,000 lb. per axle.

Of almost equal importance with the increase in the weight of motive power is the corresponding increase in the weight and capacity of freight and passenger cars. The freight car of 100,000 lb. capacity has now largely replaced those of 60,000 and 80,000 lb. capacity, which were standard a few years ago. Cars of 115,000 lb. capacity have been largely adopted by the eastern roads for coal, coke and ore traffic. Only a few months ago the Chesapeake & Ohio ordered 1,000 cars of 140,000 lb. capacity, while the Norfolk & Western built 750 gondola cars last year with a rated capacity of 180,000 lb. These cars weigh 263,000 lb. with the allowable 10 per cent overload, and although provided with six-wheel trucks, the axle loads reach 43,900 lb., or almost as much as on a locomotive. The Chesapeake & Ohio cars will weigh 210,500 lb. with overload and, as this will be distributed between four axles only, it will give axle loads of 52,625 lb. When it is considered that these cars will probably be run in solid trains, the tremendous burden on the track can be realized.

This tendency to increase the weight of equipment extends to passenger cars also, in whose construction steel is rapidly replacing wood. Although the steel passenger car has come into use only within the past seven years, practically no wooden cars are now being built, and all new equipment of this character is being built of steel or with steel underframes. On January 1, 1914, 227 roads reported to the Special Committee on Relations of Railway Operation to Legislation that they owned 58,660 passenger cars, of which 9,492 were all steel and 4,608 had steel underframes. Of the passenger cars ordered in 1913, 2,765 were of all steel construction and 171 were provided with steel underframes, while only 177 were of wood. When it is remembered that the steel cars weigh from 10 per cent to 25 per cent more than wooden cars of the same design, it can readily be seen that they will result in greater loads upon the track, especially as they are operated in solid trains and on the fastest runs. Recent extensive tests made on the Canadian Pacific and the Pennsylvania have shown that the steel passenger equipment has created as high stresses in the track as many of the locomotives.

While the weights of all classes of equipment are thus seen to be increasing, the statement is occasionally heard that we have now reached the limit of this development because of clearance conditions. It is true that on some roads the clearances now form the limitations, especially in the East. However, it is on the Pennsylvania Railroad, operating through one of the oldest and most congested parts of the country, that these new passenger locomotives with the heaviest axle loads in the country are now operating. Also the present indications are that clearance legislation of a more or less radical nature will be quite generally enacted, in which case many of these narrow clearances will be removed. It should not be assumed, therefore, that clearances will present a permanent barrier, especially in the large area of prairie country west of Chicago.

Not only have the weights of the various units of equipment increased greatly, but the amount of traffic and therefore the frequency of application of the load on the track have also multiplied. The ton-miles of freight hauled per mile of main track increased from 509,348 in 1892 to 938,313 in 1911, or 84 per cent in 19 years. The passenger service rendered has likewise increased from 77,134 passenger miles per mile of main track in 1892 to 122,756 in 1912, or 70 per cent. A more accurate comparison, however, is secured from five-year periods. Taking the five-year period ending with 1911 as compared with that of 1892-96 inclusive, the ton-miles per mile of main track increased 90 per cent. Likewise the passenger density per mile of main track increased 60 per cent.

Speed is an important factor in any discussion of the stresses in track. Here conditions are more nearly stationary. In some instances schedules for freight as well as passenger trains have been shortened. However, it is safe to say that, with the necessity for economy and retrenchment, during the past few years at least an equal number of schedules have been lengthened. The days of ruinous speed wars for passenger traffic seem to be almost over, while, with the growing realization of the economy of operation of heavy tonnage trains, freight schedules are being lengthened and more cars added wherever the traffic will permit. Thus the effect of speed has not been to increase the burden upon the track to any appreciable extent.

DEVELOPMENTS IN THE RAIL

As shown above, the weights of the motive power and equipment and the density of traffic have steadily increased while the speeds have remained practically constant. The net result has been, therefore, an increased burden on the track. The rail is the portion of the track which receives this load directly, and its function is to distribute it to the supporting ties. The rail has been materially improved within the past ten years

*Abstracted from Bulletin No. 167 of the American Railway Engineering Association.

in composition, in section, in weight and in methods of manufacture. This development has been especially pronounced during the last two years, following the deluge of broken rails during the severe winter of 1911-12.

The most important improvement has been in the character of the metal. Bessemer steel rails were first manufactured in this country about 1866 and with the rapidily increasing wheel loads they rapidly replaced the iron rails until a maximum of 3,791,459 tons were rolled in 1906. Increasing wheel loads, however, caused signs of distress and the exhaustion of the high-grade Bessemer ores made it impossible to maintain the previous standards of material. To supply this deficiency open-hearth rails were adopted. Although only appearing first in any appreciable quantity in 1903, they have already passed the Bessemer rails in point of tonnage produced and reached the high figure of 2,527,710 tons in 1913, while the production of Bessemer rails has declined until last year it was only one-third this amount. On January 1, 1912, the open-hearth rails in track were 11.43 per cent of the total as compared with 87.47 per cent of Bessemer and 1.10 per cent of special alloy rails.

Considerable attention has been given to the use of alloy rails as a substitute for Bessemer steel. Prominent among the alloy metals used are nickel-chromium, manganese and ferro-titanium. Nickel-chromium rails have been used in limited quantities on the Central Railroad of New Jersey, the Baltimore & Ohio, and other eastern roads. The tests on the Central Railroad of New Jersey did not prove entirely satisfactory, while those on the Baltimore & Ohio are still in progress. Although these rails have shown considerably increased resistance to wear, the number of breakages has been high. Without further improvement in composition, it seems probable therefore that this alloy will not meet with general adoption.

Manganese steel has come into wide use for frog, switch and crossing construction within the past ten years and to a limited extent for rails in certain locations of very heavy traffic. The advantage of manganese is its great resistance to wear. The most serious objections are its high cost, about $90 per ton, and the difficulty of drilling or cutting it in the track. It is in service in a number of places of heavy wear where it is showing considerable economy. While originally cast, it is now rolled, improving the quality and decreasing the liability of breakage.

Although not properly termed an alloy, as it does not appear in the finished product but passes out with the flux, ferro-titanium has been largely used in recent years. It acts as a scavenger in the molten steel, collecting the impurities and leaving a more sound and homogeneous metal. It met with wide adoption about 1909 when there was so much difficulty with segregation and other allied troubles and the tonnage of ferro-titanium rails reached 256,759 tons in 1910. With the change from Bessemer to open-hearth and with the more strict supervision and improved methods of rail manufacture, however, the use of titanium has decreased.

Although of doubtful value, small quantities of copper alloy rails have been rolled at intervals for different roads, the latest being an order for the Chicago, Milwaukee & St. Paul last year. The basis for the use of this alloy is the composition of some old rails imported from England many years ago which gave excellent service and which were found on analysis to contain a small quantity of copper.

Closely related to the change from Bessemer to open-hearth steel are the new specifications of the American Railway Engineering Association and of several individual railroads requiring more frequent and careful tests of the finished product as well as more careful attention to the methods of manufacture in the mills. The various measures adopted under these specifications have not brought the metal up to the highest point desirable, but they have nevertheless resulted in great improvement. It is unfortunate that defective practices may be detected frequently only after extended service and the remedies are then difficult to apply. In the same way the full benefits of recent improvements in material and in improved mill practice will not be evident for some time.

One of the most important developments in rails during the past ten years has been in section. The American Society of Civil Engineers standard sections were generally used and gave satisfaction until a few years ago, when the deterioration in the Bessemer ores combined with the heavier wheel loads resulted in a large number of base failures in these rails with their thin flanges. To increase the strength of these flanges a number of roads then designed their own sections which they are still using, while the American Railway Association designed two sections which have been adopted on many roads. One is a high section for use where great stiffness is desired, as in high-speed passenger tracks, while the other is a lower section with a heavy head for use in tracks carrying a very heavy, slow-freight traffic. Both of these sections have now been used for five or six years and have shown a great improvement over the earlier sections. There is a feeling among some engineers that the sections can be still further improved but there is at present a stronger sentiment that no more changes should be made until the American Railway Association sections have received a more thorough trial.

It would be assumed that the weight of rails has increased during the past decade with the increase in wheel loads, and an examination of the statistics shows this to be the case. In 1897, 20 per cent of the rails rolled were of 85-lb. sections and over, while 75 per cent were between 45-lb. and 85-lb. section. Five years later these percentages were 22 and 70, respectively. In 1907, 49 per cent of the rails rolled were of 85-lb. section or larger, while in 1913, 64 per cent were of 85-lb. section and over and 28 per cent were between 45-lb. and 85-lb. A summary of the weights of rail in track on January 1, 1912, shows the following percentages:

100-lb. and over	5.85 per cent
90-99-lb.	8.32 per cent
80-89-lb.	32.94 per cent
75-79-lb.	12.81 per cent
70-74-lb.	8.56 per cent
60-69-lb.	18.16 per cent
Less than 60	13.36 per cent

As shown by the percentages of the various weights of rails rolled during 1913, the proportions of the heavier sections, especially between 85-lb. and 100-lb., have increased considerably during the intervening two years so that it is safe to assert that over half the rail now in the track is 85-lb. or heavier. A recent canvass of the sentiment of railway men regarding the proper weights of rail and the advisability of adopting heavier sections showed that it was the consensus of opinion that rail lighter than 80 lb. should not be rolled, but that for the present it was not considered advisable to go to heavier sections than 100 lb. because of the frequent unfavorable results with these heavier sections.

THE TIE

Next to the rail, the tie has received the most attention in recent years. Efforts have been directed principally along the lines of timber treatment to increase the resistance to decay, of the more extended use of tie plates and of screw spikes to reduce the mechanical destruction of the timber and the development of substitute ties of steel or concrete. The greatest progress has been made with the treatment. Starting in this country about 1875 and growing slowly at first, this industry resulted in the erection of 12 treating plants by 1900. Since that time the growth has been especially rapid until now there are nearly 100 plants in operation and several under construction. The number of ties treated annually likewise increased until over 39,500,000 were thus prepared in 1913. Aside from increasing the life of any timber, the great advantage resulting from timber treatment lies in the practicability of using the so-called inferior woods which, without treatment, would not offer a resistance to decay sufficient to justify their insertion in the track.

The cost of treatment varies with the process and with the

amount of preservative injected into the timber. However, the cost of creosote treatment, injecting 10 lb. of creosote per cu. ft., averages about $0.40 per tie, of zinc chloride $0.17 and of the Card process with a combination of zinc chloride and creosote $0.25, according to Forest Service Bulletin No. 118, by Howard F. Weiss.

With the increased expenditures now being made for timber preservation, it may be assumed that more attention is being given to the selection of the treatment best adapted to the particular locality in which the ties are to be placed. Little definite and accurate information of this character is now available, but many roads are now collecting detailed information from test sections placed at representative points on the system and containing ties treated in various manners. At the present time the tendency is distinctly towards the adoption of the creosoting process. At first this did not meet with general favor because of the higher cost of treatment, and W. F. Goltra has estimated that up to 1900, only 500,000 of the 15,000,000 ties treated up to that time had received this treatment as compared with 14,500,000 treated with zinc chloride. However, in 1912 over twice as many ties were treated with creosote as with zinc chloride.

The increasing use of creosote has produced a very severe shortage of this material with a resulting rapid increase in price. The quantity of creosote consumed in the preservation of ties has increased from 56,000,000 gal. in 1908 to 108,373,359 gal. in 1913, over 62 per cent of which was imported. The shortage of high-grade creosote oil was so severe last summer as to force a number of treating plants to close down. To alleviate the shortage somewhat, a practice originating about five years ago of mixing refined coal-tar with the poorer grades of creosote oil to improve their quality, is fast gaining ground. If this is done under proper supervision and with no intention of adulteration, it appears to be justified as a commercial expedient where the high-grade oils cannot be secured.

Intimately associated with the treatment of ties as a protection against decay is the use of tie plates to protect them against mechanical wear. The adoption of tie plates has been very rapid within the past decade, owing to the increasing value of the ties, the heavier wheel loads, and the use of the softer woods. The early tie plates were of small area and only about ⅜ in. thick. As a result they soon broke or buckled, or were forced deep into the tie by the increasing wheel loads. To eliminate these conditions, the size of the plate has been increased to provide a bearing area on the tie sufficient to distribute the load without any serious breaking down of the wood fiber beneath. This has required plates up to 7 in. by 9 in. on many roads. The thickness of the plate has likewise been increased until ½ in. is now regarded as minimum good practice and ⅝ in. is standard on several roads.

The mechanical adzing of ties before insertion in the track is meeting with increasing adoption. There is secured in this way, a uniform bearing on the tie for the tie plate, and therefore, the rail. While most of the adzing is now done at the treating plants previous to treatment, some ties are adzed without treatment. This practice will undoubtedly become more common as its merit becomes evident.

Next to the rail cutting, spike killing is the most destructive mechanical agent tending to shorten the life of ties. The common chisel-pointed spike is universally recognized as being very destructive to timber. This has led to the experimental use of screw spikes, which are not only far less destructive to the fiber of the wood, but also give considerably greater rigidity and strength to the track. Many tests have been made of the relative resistance offered to displacement by cut and screw spikes, which show that the screw spike binds the rail more securely to the tie, and gives a stronger track construction. Over 800 miles of screw-spike track is now in service in this country, all of which has been installed since 1905, and 95 per cent of which has been placed within the past five years.

The principal objections raised to the use of screw spikes are the increased first cost and the greater difficulty of making track repairs and renewals requiring the removal of the spikes. On the other hand, the advantages claimed are the increased life of the ties, the decreased cost of maintenance and greater strength and stability of the track. At the present time screw-spike construction is not practical for lines of light traffic where the maintenance charges are relatively low and the economy is greatest where the maintenance expenditures are high and a higher first cost is justifiable.

In addition to these various measures for the protection of the timber tie a great deal of study is now being given to the development of substitute ties of concrete or steel, and many hundreds of such ties have been designed. Studies along this line are prompted not only by the desire to arrest the continually increasing cost, but also to secure a tie which will give greater strength to the track.

Any substitute tie must combine in large measure the elasticity of the wooden tie with the requisite strength. It must also be of such form as to be manufactured readily and must have a strong and easily-applied fastening for holding the rail and with the increase in automatic block signal mileage, it must also be readily insulated. Nearly all the ties developed so far have failed in one or more of these requirements. Concrete ties do not possess the first requirement of elasticity and break or disintegrate under the severe hammering of the moving wheels. Because of its inherent characteristics, it is doubtful if any concrete tie can be made practical, at least for high-speed main tracks.

While some of the ties now undergoing test will probably prove practical, and others will undoubtedly be designed, the only one which has stood all tests satisfactorily so far and which is being used in any considerable quantities is the Carnegie steel tie. This is an unsymmetrical I-beam section to which the rail is held by bolts and clips. Over 2,000,000 of these ties are now in service. The Bessemer & Lake Erie is the largest individual user, having over 900,000 in track. By 1915 this road expects to have its 300 miles of main tracks entirely equipped with these ties. They have been in service on the Bessemer road over nine years and the present indications are that they will have a life of over 20 years. They cost about $2.50 each, complete with fastenings and have a scrap value of about $0.75.

With the increasing attention now being given to the protection of the wooden tie and to the intelligent conservation of our forest resources, it is doubtful if the timber tie will disappear as rapidly as the conservationists would have us believe. The adoption of a substitute tie will therefore be a gradual process, brought about more by the increasing price of timber than by the absolute shortage of it, and also by the demand for a stronger track structure.

TRACK FASTENINGS

While the rail joint is a very important factor in determining the strength of the track as well as in protecting the rail from battering at the ends, there has not been a radical change in this detail of track construction in the past few years. The base-supported joints of the Continuous, Weber and similar types, which were very generally adopted for main line use about ten years ago, are still widely used. Several types of joints with depending flanges, such as the Bonzano and "100 Per Cent" are also used in large numbers. During the past two or three years, however, there has been a tendency to return to the anglebar strengthened to carry the increasing loads. The anglebar generally adopted has a heavy, reinforced head and to enable higher carbon to be used is heat-treated and oil tempered in most cases to secure the requisite strength. One condition prompting the adoption of the anglebar is the practice on a few roads of laying rail without respacing the ties in which case a non-slotted joint without base supports or depending flanges is necessary.

The track bolt has undergone no important change within the past decade except in the nature of the metal used. A track-

man with the ordinary 33-in. wrench will stretch a ⅞-in. bolt beyond its elastic limit, making it impossible to keep joints tight. To eliminate this difficulty, a bolt is meeting with wide adoption during the past three years, which is made of special steel with an elastic limit of 75,000 lb. instead of 45,000 lb. This not only eliminates the difficulty with stretching but in some instances allows a smaller bolt to be used. Vanadium is also being used experimentally in bolts, while high-carbon steel bolts oil quenched are used in large quantities. Nut locks are being generally used with joint bolts.

The increase in the density of traffic referred to above has increased the stresses developed in the track in another way, not previously mentioned. As this traffic has increased, second, third and fourth tracks have been added and the traffic on each track is all in one direction. As a result, the creeping of the rails found occasionally on heavy grades on single track, becomes severe on double track and frequently introduces very high stresses in the rails and fastenings. This condition has called for another track appliance known as the rail anchor or anti-creeper, whose adoption has received its greatest impetus during the past three or four years, one road of 2,000 miles ordering as many as 225,000 at one time and another over 600,000. Several designs are on the market, and most of which are generally efficient. Their use does not increase the strength of the track in any way, except as they prevent the addition of stresses due to rail movement. They are, however, economical in reducing maintenance expenses.

FROG, SWITCH AND CROSSING CONSTRUCTION

No other elements of track construction receive more severe wear than frogs, switches and crossings and with the rapid increase in the density of traffic there arose a demand for some form of construction which would give a longer life than the ordinary Bessemer or open-hearth construction. While these latter steels are still generally used in locations of light or medium traffic, there has been a rapid development in the manufacture and use of manganese steel at these points of heavy wear. At first considerable difficulty was encountered from the breakage of the manganese castings in service. Within the past two or three years, however, this danger has largely disappeared. As a result this material is now meeting with wide adoption wherever the life of the adjoining rails is 2 or 2½ times that of a Bessemer frog.

The Pennsylvania and several other eastern roads are using full-length switch points made of this metal. Other roads are using short points of manganese, fastened to the main switch rail and absorbing the severe wear at the point.

Another detail of track construction in which manganese is coming into use is in guard rails and within the past two years two or three different types have been introduced which are meeting with ready adoption. Considerable improvement has also been made in the design of clamps and filler blocks to hold the guard rails rigidly in position, thereby giving greater protection to the frog. The Conley frog with a raised wing to guard the wheel flanges in their proper course, thereby eliminating the necessity for a guard rail, is also being more widely used. This frog has recently been made of manganese and has also been designed as a spring frog.

BALLAST AND ROADBED

While the ballast and roadbed are more properly the foundation for the track construction than essential elements of it, the same general increase in strength is found here. As the wheel loads and the traffic have become heavier, there has been a gradual but continuous movement from the unballasted or mud section to the sand, gravel, slag, or cinder ballast and finally to crushed stone. On those roads with the heavier traffic the depth of stone ballast has been steadily increased until on the Pennsylvania it has reached a standard of 18 in. Extensive laboratory tests show that an approximate depth of 24 in. of good ballast is necessary to distribute the wheel loads evenly. Considerable attention is now being given to the feasibility of using a bottom layer of gravel, cinders or other less expensive material, covered with broken stone to secure the desired depth at less expense and to provide a more easy-riding track, while at the same time preventing the stone from cutting into the subgrade.

The same general situation exists with reference to the roadbed. With the lighter loads, banks 14 ft. and 16 ft. wide were common. Increasing maintenance charges have made it economical to widen these banks to 18 ft., 20 ft., or 22 ft., and also to give more attention to their drainage.

THE PRESENT SITUATION

From the above it can be seen that the development in all details of track construction has been marked during the past decade. In spite of all these improvements there is a prevalent impression among railway men that even more money should be spent for heavier rail, more and better ballast, wider banks, etc., to secure a still stronger track. It will be instructive to endeavor to ascertain to what extent this impression is sustained by the facts, and also to what extent the track is showing fatigue as compared with former years. Two measures by which the relative strength of the track can be estimated roughly with reference to the traffic it carries, are the trend of maintenance expenditures and the number of derailments due to defects of roadway and track.

The average annual expenditure for maintenance of way and structures per mile of line has increased from $877 for the five-year period 1892-96, inclusive, to $1,451 for the five years ending with 1911, the last year for which the complete statistics of the Interstate Commerce Commission are available, showing an increase of 66 per cent in 15 years. Since these figures are on the "per mile of main line" basis, the increase in main line mileage has already been taken into account. However, during this period the percentage of other main and side tracks has risen from 31 to 45 per cent of the first main track mileage. Therefore, while the proportion of other than first main tracks has risen 14 per cent in this time, since these tracks only require about 40 per cent of the expenditure of first main tracks, it may be assumed that 6 per cent of the increase in expenditures per mile of the line has been due to this cause.

Likewise, the growth in traffic has contributed to this increased cost of maintenance, although it is difficult to determine the exact extent. Some items such as repairs to fences and buildings are independent of the traffic. Others such as ties and ballast are affected to some extent, while still others such as rail are affected almost directly. In his monograph describing the studies made on the Union Pacific prior to its reconstruction, J. B. Berry has estimated that 37.3 per cent of the charges for maintenance were affected directly by the

Distribution of Maintenance Expenditures

Maintenance of Way and Structures	Per cent of total expenses	Per-centage affected	Net increase for traffic
Superintendence	0.963	0	0.00
Ballast	.423	25	0.106
Ties	2.992	25	0.748
Rail	.897	100	0.897
Other track material	1.021	70	0.715
Roadway and track	7.023	60	4.214
Removal of snow, sand and ice	.217	0	0.00
Tunnels	.049	0	0.00
Bridges, trestles, culverts	1.565	10	0.157
Over and under grade crossings	.068	0	0.00
Grade crossings, fences, cattle guards and signs	.348	0	0.00
Snow and sand fences and snowsheds	.021	0	0.00
Signals and interlocking plants	.550	40	0.220
Telegraph and telephone lines	.183	10	0.018
Electric power transmission	.026	0	0.00
Buildings, fixtures and grounds	1.778	0	0.00
Docks and wharves	.165	10	0.017
Roadway tools and supplies	.242	60	0.144
Injuries to persons	.104	33	0.035
Stationery and printing	.040	0	0.00
Other expenses	.024	0	0.00
Maintaining joint tracks, yards, and other facilities—Dr.	.728	40	0.292
Maintaining joint tracks, yards, and other facilities—Cr.	.555	40	0.222
	18.872		7.341

number of trains. In the accompanying table, showing the distribution of maintenance expenditures for 1911 for class A roads comprising 88 per cent of the entire mileage of the country, as reported by the Interstate Commerce Commission, together with an estimate of the extent to which each item is affected by traffic, 38.8 per cent of the expenditures for maintenance are shown to vary with the traffic.

The wear upon the track is dependent upon the tonnage and also upon the number of trains. It is evident that in view of the large increase in the average train load during the past 20 years, the wear on the track has increased more than 8 per cent, which is the increase in train miles. On the other hand, the average load per car and the percentage of revenue to dead load have so increased that the wear on the track has not increased the 98 per cent that the revenue ton-miles have, since 1892. The increased wear due to traffic lies somewhere between the 8 per cent increase in train-miles and the 98 per cent increase in ton-miles. Simply as an approximation and with a desire to be conservative, we will assume that the increase in the wear of the track is influenced two-thirds by the revenue ton-miles and one-third by the revenue train-miles. This is equivalent to an increase of 68 per cent in those maintenance charges directly affected by traffic. Upon the basis of the two analyses made above, 38 per cent of this increase will be reflected in increased maintenance charges and is equivalent to a net increase of 26 per cent in these expenditures.

The average rate paid for labor increased 18 per cent in this period. As approximately 60 per cent of all maintenance expenditures are for labor, this accounts for 11 per cent more of this total increase.

While it is impossible to determine accurately the extent to which the expenditures for maintenance materials have increased in unit costs, the increased wear having been accounted for under the increase in traffic, it will be ample to place this at 25 per cent (ties having increased perhaps 60 per cent and rails less than 10 per cent). As only 40 per cent of maintenance expenditures are for materials, this is equivalent to an increase of the total of 10 per cent.

Deducting 6 per cent for the increased proportion of secondary track mileage, 26 per cent for the increase in traffic, 11 per cent for the increased cost of labor and 10 per cent for the increased cost of material, or a total of 53 per cent from the total increase of 66 per cent, there still remains 13 per cent or practically one-fifth of the total increase unaccounted for. From the necessarily approximate nature of some of the assumptions made, it cannot be said with absolute certainty that the remaining increase of 13 per cent is due either to higher standards of track maintenance or to the necessity of spending more money to maintain the tracks to their proper standard. However, such is the natural and reasonable conclusion, especially in view of the wide margin of increase otherwise unaccounted for.

A close check upon the trend of maintenance expenditures is given by the number of men required to maintain a unit of track. The above conclusion is borne out by the fact that the number of men employed per 100 miles of line has increased 45 per cent in 15 years. Deducting the same increase of 6 per cent for increased track mileage and 26 per cent for increased traffic, we have a net increase of 13 per cent in the number of men required to maintain the tracks, checking the 13 per cent increase in expenditures.

Turning to the record of derailments due to defects of roadway and track, the quarterly accident bulletins of the Interstate Commerce Commission classify all derailments resulting in personal injuries or damages in excess of $150 under certain general heads. This record shows that those derailments due to defects of roadway and track were 257 per cent more numerous in 1913 than in 1902, when these accidents were first published in tabular form, while those due to defects of equipment increased 174 per cent and the total number increased 149 per cent in the same period. It is not fair to assume that the increase of 149 per cent in the total number of derailments in this period fairly represents the total number of derailments in these years, for undoubtedly a considerable portion of this increase is due to greater completeness and accuracy of the derailment reports as a result of increased attention to this subject on the part of the Interstate Commerce Commission and the railways. However, the relative proportions of this total due to defects of track and of equipment, with reference to each other and to the total, should not be materially affected.

Analyzing these derailments due to defects of roadway and track for the ten-year period and eliminating those due to bad ties and sun kinks, which combined form less than five per cent of the total, it is seen that those due to irregular track have increased 253 per cent, those due to soft track 215 per cent, those due to spread rail 100 per cent, and those due to broken rails 93 per cent. Thus there are three classes of derailments which are increasing faster than broken rails, all of which are due to a very large extent to lack of labor rather than material. The logical conclusion is that the track is not as strong relatively as it was 20 years ago, and that it should be strengthened in design and materials to decrease the number of failures, and to reduce the ultimate cost of maintenance.

Unlike other engineering structures, the track is capable of analytical design only to a limited degree. The only practical way by which this subject can be intelligently studied is by making an elaborate series of tests, carefully planned, to secure information under a wide variety of conditions. It is therefore highly gratifying to know that a joint committee of the American Railway Engineering Association and the American Society of Civil Engineers has been formed within the past six months to study this subject and that sufficient funds have been placed at its disposal to insure a thorough investigation. The results of this, the first elaborate study of its kind, should go a long way towards securing a track construction based on scientific principles and of sufficient strength properly to carry the loads placed upon it.

CONCLUSIONS

(1) The loads imposed on the track by locomotives and cars have materially increased within the past few years and bid fair to increase still further.

(2) Almost every part of the track has been materially strengthened or improved within the past few years.

(3) It would appear that the cost of maintenance has increased faster than the traffic, while the number of derailments due to defects of roadway has materially increased at the same time.

(4) One is therefore forced to conclude that development in the construction of track has not been and is not keeping pace with the increase in the service demanded of it.

A COMBINATION POCKET RULE AND LEVEL

The Lufkin Rule Company, Saginaw, Mich., is manufacturing a 2-ft. folding boxwood rule fitted with a spirit level on which patents are pending. The three 8-in. rule sections are each 1 in. wide, 3/16 in. thick and united by substantial brass joints. The rule is fully graduated for its entire length on both sides, one side in inches to eighths, and the other side to sixteenths. The spirit level is neatly set into and flush with the upper edge of the middle section of the rule where it is most convenient for use and securely protected by the two outer sections of the rule which fold against it on either side when closed for carrying in the pocket. Closing pins especially designed for the purpose hold the sections of the rule in proper alinement insuring a perfect bearing surface.

ABSTRACT OF ENGINEERING ARTICLES

The following articles of special interest to engineers and maintenance of way men, and to which readers of this section may wish to refer, have appeared in the *Railway Age Gazette* since September 18, 1914:

Practical Considerations in Design of Large Stations.—The features which should be studied in planning a large passenger terminal to reduce the operating costs were very carefully considered by the officers of the Kansas City Terminal Railway in designing the new union station. A discussion of these features as applicable to all large stations, written by A. H. Stone, assistant engineer, Kansas City Terminal, was published in the issue of September 25, page 555.

New Passenger Station at Pocatello, Idaho.—A short illustrated description of the passenger station which the Oregon Short Line is building at Pocatello, Idaho, was published in the issue of September 25, page 562.

Methods of Artificial Lighting for Railroad Offices.—A discussion of the requirements of artificial lighting and the advantages of indirect lighting in offices and drafting rooms by John A. Hoeveler, an illuminating engineer, was published in the issue of September 25, page 565.

New D. L. & W. Freight Station at Utica, N. Y.—An illustrated description of a modern inbound freight house recently built by the D. L. & W. at Utica, N. Y., was published in the issue of September 25, page 577.

Clearing Interchange Yard for Chicago District.—The important features of design and construction of the new clearing hump yard at Chicago, the largest gravity yard in the world, were described and illustrated in the issue of October 2, page 603.

An editorial discussion of this design was published in the same issue, page 590.

How Can Engineers Best Utilize the Technical Journals?—An abstract of a paper by John W. Alvord, consulting engineer, Chicago, containing useful suggestions as to methods of retaining for future use, data from current periodicals, was published in the issue of October 2, page 615.

New Hocking Valley Coal Dock at East Toledo, O.—An illustrated description of the new coal dock of the Hocking Valley at East Toledo, Ohio, providing two tipples, each with a capacity of 40 cars per hour, and a 3,000-car storage yard, was published in the issue of October 9, page 647.

New Algoma Central Engine House and Shops.—A rectangular engine house of steel frame construction has recently been built by the Algoma Central at Sault Ste. Marie, Ont., the design being adopted principally on account of climatic conditions. The reasons for this design and the details of construction were included in an illustrated article in the issue of October 16, page 698.

An editorial comment on this rectangular engine house was published in the same issue, page 682.

Tests of Vanadium Steel Rails.—A description of laboratory tests on the first steel rails ever rolled with vanadium alloy was published in the issue of October 16, page 704.

An editorial comment on this new development in rail manufacture appeared in the same issue, page 681.

MAINTENANCE OF WAY MASTER PAINTERS' CONVENTION

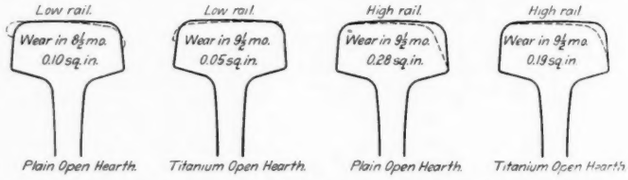
The eleventh annual convention of the Maintenance of Way Master Painters' Association will be held in the Hotel Tuller, Detroit, Mich., November 17-19, inclusive. The program includes the following papers: Proper Glazing, by Fred Rieboldt, general paint foreman, C. M. & St. P., Milwaukee, Wis.; Interior Finish and Painting of Concrete, by W. R. Parker, John Lucas & Co., Inc., Chicago; Bridge Staging, by C. H. Plummer, foreman painter, C. R. I. & P., Topeka, Kan., and H. B. Wilson, B. & L. E., Garric, Pa.; Fire Retardant Paint (illustrated by stereopticon) by H. A. Gardner, Institute of Industrial Research, Washington, D. C.; Paint Defects, Their Cause and Cure, by J. H. Wykes, National Lead Company, Chicago, and the Economy of Skilled Mechanics, by William H. Brown, Painters' Magazine, New York. In addition to the regular program the following open questions will be discussed: Does It Pay to Use Good Paint on Stations; Best Methods of Enameling Woodwork; Sanitary Conditions and Cleanliness Around Bunk Cars; Priming and Patchwork Done by Carpenter Gangs; Making Estimates on Bridge Painting; Is it Economy to Use Putty on Roundhouse Windows; Safety First as Applied to Handling Bunk Cars; Does Painting Roofs Act as Fire Protection; Is it Economy to Have Switch Stands and Targets Done by Section Forces; The officers of this association for the past year include, C. H. Plummer, president, C. R. I. & P., Topeka, Kan., and T. I. Goodwin, secretary-treasurer, C. R. I. & P., Eldon, Mo.

THE PRESENT STATUS OF FERRO-TITANIUM IN RAIL MANUFACTURE

In the widespread investigations of the rail problem during the past few years one of the defects most frequently encountered has been that of segregation. So common has this condition become that it was stated on the floor of the convention of the American Railway Engineering Association a year ago that 50 per cent of the rail failures would be eliminated by securing sound metal of comparatively even composition. As a result attention has been directed very largely toward the making of sound metal, free from segregation, and various methods have been advanced, prominent among which has been the addition of titanium to the metal in the ladle previous to pouring. When used in moderate quantities the commercial alloy, ferro-carbon titanium, is a powerful deoxidizer, which liquefies the slag and assists in removing the oxides and other impurities, passing off with the slag and leaving but slight trace of its presence in the finished product.

Titanium was first used commercially as a scavenger of steel in 1907, since which time it has been widely adopted in the manufacture of steel for a wide variety of uses. Naturally, one of its early applications was in rail steel. At the time of its introduction into this field the production of Bessemer rails had reached its high point and had started on its rapid decline, being replaced by open hearth steel. However, the tonnage of Bessemer rails produced still exceeded that of open hearth rails until 1911, so that the first applications of ferro-titanium were with Bessemer steel.

A number of difficulties were encountered here. In the first



Typical Comparisons of Rail Wear on Low Rails Selected from One Road and High Rails from Another

place, the specifications governing the use of ferro-titanium in Bessemer steel require that the steel shall be allowed to stand in the ladle three minutes after the alloy has been added before pouring, to enable the titanium to permeate the entire charge, and that the slag from the ladle shall be dumped after each pouring. As the mill men are paid on a tonnage basis, and this delay tended to decrease the output of steel, this requirement met with their opposition and they disregarded it as far as possible. Furthermore, as the application of ferro-titanium to rail steel was a new departure later developments have shown that certain errors were made by the manufacturers of the alloy in the amount of titanium recommended for use and in other details. These conditions, encountered at the time when the Bessemer ores were rapidly deteriorating, gave rise to several failures, which have seriously retarded the more general adoption of this alloy. However, numerous other orders rolled at this time have given very satisfactory results.

With the rapid substitution of open hearth for Bessemer rail steel, and the prospects that the production of Bessemer rails will continue to decrease, efforts directed toward the more general introduction of ferro-titanium have now been concentrated on open hearth steel. Here the reception has naturally been slow, although the tonnage of titanium open hearth rails in the track has been increasing steadily. With the adoption of open hearth rails with the consequent increase of about $2 per ton in cost, there was a natural hesitancy on the part of the railroads about incurring further expense for titanium until there was an opportunity to see to what extent the substitution of open hearth steel alone would accomplish the desired improvement. It was soon found that

open hearth steel presented the same problems of segregation that were present before. Accordingly, a number of roads have used titanium with open hearth rails in considerable quantities since 1910.

The advantages claimed for the ferro-titanium treatment are increased resistance to wear and a reduced number of breakages. With the desire of ascertaining to what extent these results are accompanying the addition of titanium to rail steel, the manufacturers are conducting careful and extensive investigations in the laboratory, and at the same time are watching closely the service of these rails in the track. Beginning with last year, samples of A-rails have been secured from each rolling of titanium-treated rails, accompanied, wherever possible, by similar samples of untreated rails rolled under the same specifications in the same mill order, and under as nearly as possible the same general conditions. These samples are selected by the inspectors at the mills at the time of rolling, and are sent to the laboratory, where unusually thorough investigations have been conducted. Seventeen such comparisons have already been completed and made public by the manufacturers through a series of seven rail reports. These tests include not only the ordinary chemical analyses and physical tests for elastic limit, ultimate strength, elongation and reduction of area, but in addition four special physical tests, including the Brinnel hardness test, an impact resistance test, the White-Souther test, whereby a specimen is subjected to a reversal of stresses at the rate of 2,600 reversals per minute, until failure or a maximum of 40,000,000 reversals, and the Landgraf-Turner endurance test, in which a specimen is bent backward and forward through a small angle at the rate of 400 blows per minute. As the complete results of all of these tests have already been made public through the series of rail reports, the results will not be discussed here other than to point out the more uniform character of the material and the greater endurance of the treated rail.

In actual practice the importance attached to segregation is shown by the clause inserted in the tentative specifications of one important eastern road requiring that the percentage of carbon in the web shall not exceed that in the head of the rail over 12 per cent. To determine the influence of titanium in reducing the segregation within these limits, 79 heats of plain open hearth and 31 of titanium-treated open hearth rails with the standard percentage of 0.10 per cent of titanium were rolled recently under the same conditions and with the standard discard of 9 per cent at one of the eastern steel mills for three eastern roads as a part of larger commercial orders and analyses of the A-rails were made in compliance with these proposed specifications. The average variation in the carbon content of the samples from the heads and webs of the specimens rolled from untreated steel was 17 per cent and the maximum variation 40 per cent, while only 29 of the 79 heats were under the required maximum limit of variation of 12 per cent. On the other hand, the analyses taken from the 31 heats to which 0.1 per cent of titanium had been added showed an average variation of 3.1 per cent and a maximum variation of 11.5 per cent, the one heat with this maximum being the only one which failed to comply with the specifications.

Owing to the limited time that titanium-treated open hearth rails have been in the track, no conclusive data can be secured at this time, either regarding decreased rail failures or increased wear. However, as these rails have now been in service up to a maximum of four years, considerable data are available for comparative purposes.

With reference to breakage, the records of the Chicago & Alton, while limited, are perhaps the most accurate. This road purchased 22,000 tons of 90-lb. open hearth A. R. A. type-A rail in 1913 from five different mills, 6,000 tons of which were treated with 0.1 per cent of titanium. These rails have now been in the track from 15 to 18 months and up to September 15 there have been 14 failures in the untreated rails and none in the titanium rails.

However, the greatest attention has been directed towards titanium-treated rails because of the claims made for increased wear. Wherever possible, the manufacturers have endeavored to have experimental sections of rail so laid that direct comparisons may be made with other rails rolled in the same year, under the same specifications and at the same mill and carrying the same traffic under the same conditions of grade and curvature. In most cases this has not been realized in its entirety and since the rails are laid by the railroad companies with their forces, it has been found that where titanium-treated rails have been laid on curves, the entire curves have been relaid, making a direct comparison impossible. As a result, it has been necessary to compare the wear of these rails with that on other rails on similar curves carrying similar, but not the same traffic. Measurements of the wear of the rails in these test sections in the various locations have been made from time to time by R. W. Hunt & Co., acting for the manufacturers, and the results of several such tests so far as they have now progressed are given below.

The tests of longest duration are those on the Boston & Maine, the Boston Elevated, the Delaware & Hudson and the Lehigh Valley. Although recent measurements have been made of these rails on some of these roads, the results are not yet available and since the data secured at the last previous measurement have already been published it will not be repeated here.

One of the more recent measurements is that made on the Chicago, Milwaukee & St. Paul during the past summer. Titanium rails of 90-lb. A. R. A. type-A section were laid on an 8-deg. curve and two per cent grade near Grace, Mont., in August, 1913. After 9½ months' service, measurements showed a total average loss of head of 0.0717 sq. in., or 0.018 sq. in. per million tons moving over them. The closest comparison that could be made on any curve laid with standard open hearth rail was a 10-deg. curve on a 1.7 per cent grade near Garcia, Wash., where 90-lb. open hearth A. R. A. type-A rails were laid in September, 1913. After 8½ months' service these rails showed a loss by wear of 0.14 sq. in., or 0.0639 sq. in. per million tons of traffic. This gives a ratio of wear of 1:3.55 in favor of the titanium, although the differences in the location of these curves introduce an element of inaccuracy. Similar comparisons of the wear per million tons on all 10-deg. curves on the Rocky Mountain, Columbia and Coast divisions of the St. Paul showed the following ratios: Titanium 1.00, open hearth rails on Rocky Mountain and Columbia divisions 1.52 and open hearth rails on the Coast division 2.72.

Measurements have also been taken on 10 ferro-titanium open hearth rails with 0.1 per cent of titanium, and two standard open hearth rails in the eastbound track of the Atchison, Topeka & Santa Fe between Morely, Colo., and Wootton. These rails were laid in 10-deg. curves on a 3.5 per cent compensated grade descending. The titanium rails were laid in the track in August, September and October, 1912, while the standard open hearth rails were laid in September, 1913. Calculated upon the basis of one million tons moving over the rails, the average wear of the 0.1 titanium-treated rails was 0.0335 sq. in. and of the standard open hearth rails 0.12 sq. in. Assuming the wear on the 0.1 per cent titanium-treated rails as 1.0, the relative wear on the untreated rails was 3.58.

Because of the small number of standard open hearth rails measured in the eastbound track, three rails of this same character were measured in the westbound track after having been in service from August, 1913, to March, 1914. Again assuming the loss per million tons for the 0.1 per cent titanium-treated open hearth rails as 1.0, the wear of the standard open hearth rails in the westbound track is 3.43. While the service demanded of the rails at this point on the Santa Fe is unusually severe, the small number of standard open hearth rails measured for comparison renders the result somewhat inconclusive.

CARE IN UNLOADING MATERIAL

By Chas. L. Van Auken

Consideration of the fact that the cost of handling freight at terminals is frequently greater than the cost of transportation between the terminals, and also that the demoralization to a track gang when material has to be redistributed, shows that while unloading track material cheaply and with the least amount of labor is a problem of great importance, it is of equal or greater importance that the correct quantities of materials be unloaded, and that these quantities be correctly spaced along the right-of-way. Economy in unloading track material may be very easily offset by the increased cost of track laying if there is too much or too little material, or if it is not placed conveniently. This is especially true when relaying rail, building double track or putting in new switches. If track is being laid with a track laying machine, the materials are used immediately as distributed in order to provide a track on which to move the machine forward; thus the distribution of rails and angle bars is correct, the ties are usually handled correctly by the machine, and the problem narrows itself to the proper loading of the material, and to the distribution of the finishing material behind the machine. Again, even if there is poor distribution of spikes, bolts, etc., behind a track laying machine, the "dumpy" may be used advantageously to redistribute the material, and anything lacking is easily obtained from frequently passing material trains.

When building a second track the material is usually distributed by a work train, which necessarily uses a track on which there is more or less traffic, and the problem of proper distribution of materials becomes a serious one, requiring the best of supervision. The material is generally distributed far ahead of the track gang; in fact, the work train may have been taken off the work entirely when track laying begins; then if there is a shortage of rail the track gang will be forced to transport rails by hand or "dumpy" until a work train can be procured to distribute more rails. It is better for the track laying gang if there are too many rails and ties rather than too few. However, all surplus material must afterwards be loaded, which is an unnecessary expense. Shortage of ties tends to temporarily break up the organization of the track layers, for if the men are properly placed to handle the work when the ties are properly distributed some part of the gang will be underworked or overworked when there is a shortage of ties. Also when fill-in ties arrive, after the track is laid, the organization must be broken up to go back and finish up the track.

When distributing rails with a work train on a track under regular traffic, the train is frequently run to a siding to let another train pass. In these intervals the gang should be kept busy setting up the rails end to end on the shoulder of the grade. If there is time to set up all the rails in this manner, the distribution will be absolutely correct, giving a corresponding advantage when laying or relaying track.

If just enough rails and ties are unloaded, and yet they are not properly placed, i. e., if they are unloaded in bunches, the redistribution must be made with a "dumpy" on the main track, and the "dumpy" must usually be protected by flagmen, which again means the breaking up of the rail gang organization.

All of these arguments may not be necessary to prove that track material should be properly distributed; that fact is apparent, but nevertheless it is true that many times track material is not properly distributed. Correct distribution from the main track can be obtained by noting the standard length of track rails, spotting the material train with respect to the rail joints, and unloading spikes, angle bars, ties, etc., in the proper proportion. If it is desired to keep the train in motion while distributing any material or materials (such as is frequently done in distributing bolts, spikes, angle bars, etc.), an easier method is to gage the distribution by the position of telegraph poles, which are spaced at standard distances and can be seen without trouble by the men on the cars.

It is important to have the proper amount of switch material on the work train and to see that the complete material for each switch is unloaded. While advisable, the distributing of the different parts is not so important as in track laying.

The importance of having on hand all the material required before starting a job cannot be over-estimated. Lack of material causes loss of money while a gang is being delayed, and causes a demoralization of the gang organization. The men soon find out that there is a delay, and become indolent on the work which the foreman improvises in order to kill time. Then when real work starts again, it is a hard task for the foreman to get the laborers in the habit of working.

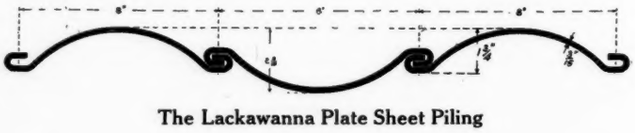
It is easy to obtain tables which show the number of spikes and track bolts per keg, and nut locks are also furnished in boxes containing a certain number. These materials and angle bars or joints can be unloaded while the train is in motion. It is necessary, of course, to exercise care on high embankments, for if a keg falls on its side, it will roll to the bottom. In general, however, it is possible to drop the keg so it will fall on end and will not roll. The writer once distributed spikes, bolts, nut locks, angle bars and joint ties for four miles of relaying, without stopping the train more than two or three times. The gang was composed of American hobos, who are more easily handled on work of this kind than foreigners.

Trainmen who have seen much construction work and who are willing to constantly assimilate new ideas, make the best men for work trains. It is advisable to keep the same crews on the same kinds of work as far as practicable. Spotting cars carefully is necessary in loading and unloading track material. For this reason the engineer should use the air consistently, so that the trainmen can estimate just when to give the stop signals. Some engineers never make two stops the same, and they are the despair of the foreman, and of the conscientious trainman. Too great emphasis cannot be laid upon the importance of spotting unloading trains systematically by reference either to rail joints or to telephone poles, and then having exactly the same amount of materials unloaded at each spot.

A NEW TYPE OF SHEET PILING

A new type of steel sheet piling which is cold rolled from steel plates has recently been placed on the market by the Lackawanna Steel Company, Buffalo, N. Y. This section has a width of eight inches between joints, the metal is 3/16 in. thick and the completed wall 2 9/16 in. thick. The weight per sq. ft. of wall is 11.5 lb., and the weight per lineal foot of section is 7.66 lb.

This sheet piling is particularly adapted to use as a cut-off



The Lackawanna Plate Sheet Piling

wall in levee construction, a core wall in an earth dam or a cut-off wall around a masonry foundation in saturated soil. The advantages under these conditions are its low weight and cost per sq. ft. of wall, the higher resistance offered to the passage of water and its immunity from attack by the teredo and natural decay which would affect timber. It is claimed that its method of manufacture insures uniformity in all sections and that the form of interlocks used gives free driving as well as great resistance against the passage of water.

Wood Preserving Industry May Suffer From War

Suggestions for Avoiding Possible Injury Resulting from a Shortage in the European Creosote Supply

By Clyde H. Teesdale

In Charge of Wood Preservation Forest Products Laboratory, Madison, Wis.

The present European situation has had a very serious effect upon the wood preservation industry in this country. At the beginning of 1914, there were 94 treating plants in the United States, with an aggregrate annual capacity of over 300,000,000 cu. ft. of timber. Actually 153,613,888 cu. ft. were treated in 1913. Of this, over 106,000,000 cu. ft. were treated with creosote, 36,000,000 cu. ft. with zinc chloride, and 8,000,000 cu. ft. with a mixture of creosote and zinc chloride. A total of over 108,373,000 gal. of creosote was consumed. Of this, 41,700,000 gal. was produced in this country, and over 66,673,000 gal., or 62 per cent of the total used, was imported, principally from Germany and England. The present crisis in Europe has cut off entirely the supply of oil from Germany, and much of that from England, and consequently a very serious shortage is imminent.

It would seem possible for the United States to be wholly independent of Europe for its wood preservatives, and it should not be necessary to shut down a single treating plant, or to reduce the amount of timber now being treated because of the threatened creosote shortage. There appear to be seven possibilities of solving the question:

1. An increased use of zinc chloride.
2. The use of the so-called empty cell processes.
3. The use of mixtures of creosote and zinc chloride.
4. The use of water-gas-tar creosote.
5. Mixing creosote with crude oil.
6. The use of wood-tar creosote.
7. The use of sodium fluoride.

1. *Zinc Chloride.*—The best known preservative that could be substituted for creosote is zinc chloride. The value of this preservative has been thoroughly tested out during the past 80 years. In some situations, it does not add as much to the life of timber as creosote, and with the prices which have prevailed the annual charge against a creosoted crosstie has been less than for one treated with zinc chloride. The following table (from Forest Service Bulletin 118) gives the estimated saving due to the treatment of crossties with preservatives:

Species	Estimated life			Cost of ties			Annual charge in track			Annual saving of treated over untreated ties	
		Treated			Treated			Treated			
	Untreated	10 lb. creosote per cu. ft.	½ lb. $ZnCl_2$ per cu. ft.	Untreated*	10 lb. creosote per cu. ft.	½ lb. $ZnCl_2$ per cu. ft.	Untreated	10 lb. creosote per cu. ft.	½ lb. $ZnCl_2$ per cu. ft.	10 lb. creosote per cu. ft.	½ lb. $ZnCl_2$ per cu. ft.
	Yrs.	Yrs.	Yrs.								
Black locust	20	..	..	†$0.60	..	..	$0.080	...	...	...	...
Redwood	12	..	..	.53	..	..	.104	...	...	...	...
Cedar	11	..	..	.46	..	..	.103	...	...	...	...
Cypress	10	..	..	.41	..	..	.104	...	...	...	...
White oaks	8	..	..	†.60	..	..	.155	...	...	...	...
Longleaf pine	7	20	..	†.52	$0.89	..	.159	$0.103	...	$0.056	...
Chestnut	7	14	11	.44	.81	$0.61	.145	.122	$0.121	.023	$0.024
Douglas fir	6	15	11	.41	.78	.58	.160	.114	.118	.046	.042
Spruce	6	14	11	.49	.86	.66	.175	.127	.127	.048	.048
Western pine	5	17	12	.53	.90	.70	.215	.115	.123	.100	.092
White pine	5	14	10	.43	.80	.60	.192	.121	.129	.071	.063
Lodgepole pine	5	16	11	.46	.83	.63	.199	.113	.124	.086	.075
Tamarack	5	15	11	.41	.78	.58	.187	.114	.118	.073	.069
Hemlock	5	15	11	.33	.70	.50	.169	.106	.108	.063	.061
Red oaks	4	20	12	†.45	.82	.62	.240	.098	.114	.142	.126
Beech	4	20	12	.36	.73	.53	.214	.090	.104	.124	.110
Maple	4	18	12	†.45	.82	.62	.240	.104	.114	.136	.126
Gum	3	16	11	.52	.89	.69	.338	.119	.131	.219	.207

* In most cases, prices quoted were taken from report on "Crossties Purchased 1909," Bureau of Census.
† Prices quoted based on general observations.

In this table, creosote was assumed to cost about 8 cents a gallon, placement in the track 15 cents a tie, and tie plates 25 cents a tie with interest charges at 5 per cent. Should the present situation result in a material increase in the price of creosote, it is obvious that the annual charge for ties treated with zinc chloride would become the lower, and its substitution for creosote, to a large degree, would be warranted on the basis of cost.

2. *Empty Cell Treatments.*—A large amount of timber has been treated with creosote by the so-called empty cell processes. Usually ties, bridge timbers, etc., are treated with 10 or 12 lb. of creosote per cu. ft. By the empty cell process, however, this can be reduced to 5 or 7 lb. per cu. ft.

3. *Mixtures of Creosote and Zinc Chloride.*—In 1913, 8,000,000 cu. ft. of timber was treated with a mixture of creosote and zinc chloride. In this case, about 3 lb. of creosote is usually injected into each cu. ft. of timber. Both of the above processes possess merits, and in the last few years have been used widely. It seems likely that the present situation can be partially relieved by an increased use of such methods, in which a smaller amount of creosote is required to treat a given volume of timber.

4. *Water-gas-tar Creosote.*—Further relief could also be had by utilizing creosote from water-gas-tar. A large amount of the water-gas-tar produced is now burned or thrown away. Much has been used for treating timber, usually in mixtures with coal-tar creosote. In composition it is very similar to the latter, but probably has less value in preventing decay. In experiments now being made by the Forest Products Laboratory, untreated specimens of southern pine were destroyed, after nine months' exposure in the Gulf of Mexico. Specimens treated with water-gas-tar creosote and coal-tar creosote were practically sound, however, after two years and are still in service. A pile was removed from Pensacola bay, Florida, after 33 years of service and was in fairly good condition. An analysis of the oil in this pile showed that it was very similar in composition to much of the water-gas-tar creosote now being made. It seems possible, therefore, that piling for service in salt water could be treated with water-gas-tar creosote with excellent results. Certainly it would pay much better to use this product than to drive piling that has not been protected from the borers.

5. *Creosote and Crude Oil Mixture.*—One of the important qualities of a wood preservative is its toxic property, or its power to poison the food supply of the organism that causes decay. In experiments made at the Forest Products Laboratory by the so-called "Petri dish" method, 0.55 per cent of a coal-

tar creosote prevented the growth of *Fomes annosus*, and 0.225 per cent prevented the growth of *Fomes pinicola*, both of which are wood-destroying fungi. If these figures could be applied directly to the case of treated wood, only 0.343 and 0.140 lb. of creosote per cu. ft. respectively would be required to prevent attack. These data indicate that the amount usually injected into wood is from 20 to 50 times greater than the amount actually required to prevent attack. In the case of zinc chloride, 0.50 per cent was required to prevent the growth of *Fomes annosus*, and 0.75 per cent for *Fomes pinicola*. This corresponds to 0.312 and 0.468 lb. per cu. ft. respectively. Usually 0.5 lb. of zinc chloride is injected into the wood, and excellent service results have been obtained. It would seem obvious, therefore, that in comparison with zinc chloride, much more creosote is being introduced into timber than is required to prevent decay.

Petroleum oils tested by the petri dish method appear to be without toxic properties. They have been used to some extent in timber preservation, and with a certain degree of success, because of their property of excluding water from the timber, water being essential to the growth of fungi. In view of the highly toxic properties of coal-tar creosote why could this not be mixed with petroleum oils and still successfully preserve the timber? If the above toxic limits of these preservatives would hold when applied to treated timber, 0.5 lb. of creosote per cu. ft. of timber should preserve it better than a similar amount of zinc chloride. Why should not, therefore, a mixture of high grade coal-tar creosote and crude oil be used, in proportions even as low as 10 per cent of the former, with excellent assurances of success?

Had all of the timber treated with creosote in the United States in 1913 been treated with a mixture of 10 per cent creosote and 90 per cent crude oil, the consumption of creosote would have been 10,837,000 gal. Since 41,700,000 gal. of domestic oil was used, there would have been a surplus of over 30,000,000 gal. There are, of course, many situations where the use of such a mixture should not be considered, for example, the treatment of piling for salt water, or the brush treatment of telephone poles. Should such a mixture be used for ties alone, however, this country could produce a large surplus of creosote oil.

6. *Wood-tar Creosote.*—A further source of wood preservatives in this country may be found in the tars produced by the destructive distillation of wood. These are of two kinds, those from hardwoods and those from coniferous woods. At present, these tars are a nuisance to the plants producing them, and are either burned or thrown away. In the crude state they are absolutely unsuited for wood preservation. It is possible, however, to refine them and produce oils comparing very favorably with coal-tar creosote. One sample of creosote produced from hardwood tar was submitted to the Forest Products Laboratory that was more toxic than the coal-tar creosote mentioned above. Its toxic limit in the case of the fungus *Fomes annosus* was between 0.12 per cent and 0.24 per cent. Its specific gravity, range of distillation, specific viscosity, ease of penetration into wood, and volatilization from wood were about the same as the creosote used for comparison, the latter being a commercial product of good quality. It was much more corrosive in its action on flange steel than the coal-tar creosote, although this was but little greater than the corrosive action of a 3 per cent zinc chloride solution. It would seem possible to further refine this oil, and remove this objection.

Several concerns are now prepared to manufacture refined hardwood creosotes, and it seems likely that at least 10,000,000 gal. could be placed on the market annually.

7. *Sodium Fluoride.*—One of the most promising of the new preservatives that are now being experimented with is sodium fluoride. This is a water soluble salt, and can be produced very cheaply in this country. At least one company is now prepared to produce it in large quantities. Its principal advantage compared with zinc chloride is its high toxic properties, and its low solubility in water. In the petri dish experiments at the Forest Products Laboratory, 0.225 per cent prevented the growth of *Fomes annosus*, and 0.15 per cent prevented the growth of *Fomes pinicola*. In these cases it was from 2 to 5 times as toxic as zinc chloride, and about the same as the coal-tar creosote. Zinc chloride is soluble in water in all proportions, while only 3½ to 4 per cent of sodium fluoride can be dissolved in water. Furthermore, it is only about 10 per cent as corrosive in its action on flange steel as zinc chloride.

Very good results have been obtained from the use of fluorides in Europe, especially in Austria, where several thousand telephone poles have been treated. The excellent prospects of the successful application of this preservative led the Forest Products Laboratory to institute service tests of timber treated with it. Several hundred mine ties treated with fluorides were installed in January, 1914, in the Birmingham, Ala., district, and 300 ties treated with sodium fluoride are about to be installed in a test track on the Baltimore & Ohio.

Many preservatives have been tested by the Forest Products Laboratory, and the results of these experiments will be published as a bulletin of the Department of Agriculture about January 1, 1915.

TRACK INSPECTION ON THE PENNSYLVANIA

The annual award of premiums for the maintenance of roadbed on the Pennsylvania Railroad, amounting to $5,400, was made on September 22 after an annual inspection made by General Manager S. C. Long and a party of about 300 operating officers.

As in the past, these awards are based on monthly inspections made by a committee of maintenance of way officers consisting of W. G. Coughlin, engineer maintenance of way, chairman; A. B. Clark, assistant engineer maintenance of way, in charge of roadway and track; J. J. Rhoads, superintendent of the Media division, and E. J. Cleave, superintendent of the Cresson division. The prizes were awarded as follows:

The first premium, that of $1,200, of which $800 goes to the supervisor and $400 to the assistant supervisor having the best line and surface between New York and Pittsburgh and Philadelphia and Washington, was awarded to C. M. Wisman, supervisor, and H. M. Grimm, assistant supervisor, who have charge of the track between Tullytown, Pa., and Deans, N. J. The other prizes were:

Four premiums of $800 each, $600 for the supervisor and $200 for the assistant for the best line and surface on a main line superintendent's division between New York and Pittsburgh and Philadelphia and Washington, awarded as follows: C. Z. Moore, supervisor, C. L. P. Russell, assistant supervisor, in charge of track between Dillerville and Harrisburg, Pa. W. T. Hanley, supervisor, J. B. Baker, assistant supervisor, in charge of track from west of Rockville bridge to Thompsontown, Pa. W. S. Wilson, supervisor, C. W. Barwis, assistant supervisor, in charge of track between Altoona and Portage, Pa., including the Horseshoe Curve. G. H. B. English, supervisor, C. M. Hursh, assistant supervisor, in charge of track between Wilmington, Del., and Perryville, Md.

A special improvement premium of $1,000, $700 to the supervisor and $300 to the assistant, for the greatest improvement made in line and surface on the main line between New York and Pittsburgh and Philadelphia and Washington, was awarded to A. W. McClellan, former supervisor, and H. L. Pierce, assistant supervisor, for the section of track between Donohue and Wilmerding, Pa.

THROUGH TRAIN SERVICE BETWEEN ARGENTINA AND CHILE SUSPENDED.—In view of the fact that no passenger trains had been able to pass over the Chilian section of the Transandine Railways since the end of May, the National Direction of Railways Office has authorized the suspension of the international train to and from Buenos Ayres until further notice.

FATIGUE OF RAILS

BY PAUL KREUZPOINTNER*

In recent issues of the *Railway Age Gazette* the phenomena of transverse fissures in rails and their causes have been ably discussed by high authorities, the conclusion being drawn that their origin must be sought in improper mill work rather than in the overloading of rails due to the rails being too light for the present weight of rolling stock and speed of trains. If the origin of these interior transverse fissures, with subsequent fracture of the rail, or rails, is due to mill work then the cause would be either slag inclosure, segregation with the resulting lack of homogeneity of structure, or internal strains due to irregular cooling. Upon the other hand, if overloading of the rails produces transverse fissures, breakage of rails would be due to fatigue of the metal with all the characteristics of fatigue fractures.

The peculiarities of the fractured surfaces of broken rails would then materially help us to draw safe conclusions as to whether the cause was improper mill practice or fatigue due to overloading of the broken rails. During all the discussions on the subject of transverse fissures the writer has

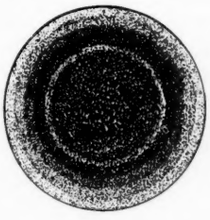


Fig. 1

Fig. 2

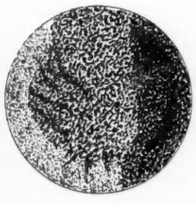


Fig. 3

not seen any mention of the difference in appearance of fractures of structural material due to improper mill practice alone, or to improper heat treatment and fatigue, or to fatigue alone with an otherwise properly treated metal of uniform structure. Frequent comparisons of fractures of the same class of structure, and subject to the same forces of destruction, will furnish us with sufficient proof that there are characteristic differences in the appearance of fractures of structural material indicative of the physical condition of the metal when it went into service, thus strengthening the observations made in other directions.

If we claim that overloading of the rails is the cause of present vexatious troubles in railroading we then assume that the metal was in a normal physical condition, free from the disturbing influences of segregation or internal stresses and therefore the fracture of the rail, broken in service, should exhibit all the characteristics of a detail fracture due to fatigue induced by overloading.

Leaving out of consideration the possibility of the design of the rail being so faulty and weak as to cause sudden fracture under overloading without fatigue, we should find the fracture of a rail broken through overloading exhibiting two or more elliptically-shaped lines of greater or less distinction, either in the head or in the foot, and, beginning at the surface, the texture or grain of the broken area included between each two lines, varying from very fine in the first of these areas to the well known coarseness of a sudden fracture, the texture being uniform without being marred or broken by slight or heavy creases. In Fig. 1 we have an example of the characteristic fracture of an overloaded structure, in this case the detailed fracture of an axle.

It must be remarked here that the shape or outline of the structure does not influence the characteristic feature of a fatigue or detail fracture. The shape may, and often does, influence the configuration of the lines of individual breaks, but it does not alter the character of the break, hence the appearance of the fracture in Fig. 1 is as representative of a detail fracture of an overloaded structure of wrought iron or steel as may be found. Nor is this appearance influenced much by the degree of hardness of steel below the hardness of tool steel; there may be no distinct lines indicative of individual breaks with a slightly different texture of the break from lower grade steel, but the character remains the same. Neither does the speed at which the structure is broken seemingly change the general character of the fracture caused by fatigue. The general character of the detailed fracture of a firebox sheet, ruptured by the slow pulsations of the sheet, does not differ from the general character of a fatigue fracture of a fast running axle. Any deviation then from these general and uniform characteristics of a fatigue fracture of a physically sound steel structure indicates a disturbed physical condition of the metal, producing a variety of results destructive in their nature and due to improper treatment of the steel in its fluid or subsequent solid state.

How mill practice affects the nature of the fracture of a steel structure as revealed by its appearance is shown in the following illustrations. Fig. 1 is an ideal detail, or fatigue, fracture with a number of well-defined concentric rings, the axle breaking little by little and the journal having dropped off into the box without doing any damage. Fig. 2 illustrates the influence of a mechanical defect upon the nature of the fracture, the break starting at a seam or elongated blowhole and the metal being good otherwise. Fig. 3 started to break in detail, but was interrupted by segregation, producing sudden fracture of two different types, the segregated portion coarse and open with a closer grain for the rest. Fig. 4 shows a seam formed by a succession of blowholes joining each other and their walls, tearing on being stretched under the forging process, united into one continuous seam. In Fig. 5 we have a combination of seam and internal transverse fissure, extending outward with segregated spots in the center. Fig. 6 presents a well-defined internal fissure due to internal stresses caused by improper heat treatment. That the shape of the fissure is round and not oval as in a rail may be accounted for by the shape of the structure and the uniform

Fig. 4

Fig. 5

Fig. 6

distribution of the vibrations caused by shocks and vibrations. The "creases" are indicative of internal stresses due to improper heat treatment. "Creases" of this kind are always a sign of a disturbed condition of the steel, acting wedge-like in forcing the steel apart.

CAUSES OF DIFFERENCE IN FRACTURES

In the foregoing we have seen how an overloaded steel structure breaks slowly in detail due to fatigue without showing transverse fissures, provided the physical condition of the metal is good, that is, free from the admixture of impurities from too much segregation, from spongy center, and is of uniform texture and without internal stresses due to incomplete heat treatment. We find the causes for this difference in fractures of structural steel in good condition or disturbed by defective treatment in the plastic and elastic properties of iron and steel, the former permitting the metal to flow under the application of extraneous forces and the latter allowing it to recover from the destructive influences

*Mr. Kreuzpointner was connected with the physical laboratory of the Pennsylvania Railroad for 31 years, and was in charge of the physical testing of materials during that time.

of shocks, vibrations or excessive strains. This ability to recover is greater in structural steel than in wrought iron and is the reason for steel being given the preference over wrought iron for structural purposes. Elasticity, which is inherent in all metals, and varies in degree only, but not in kind, possesses the peculiar quality of recovering, at least partly, the ground it loses when the metal is subjected to strains and stresses, producing the so-called elastic reaction in metals, this elastic reaction being more pronounced and of longer duration in steel than in iron. This elastic reaction tries to establish an equilibrium when the limit of strength and of elasticity has been lowered by overstrains, establishing new limits of strength and elasticity. If forces deforming a metal act quickly and are released quickly, the elastic reaction is slight. If, however, the forces act slowly, reaction then becomes effective, trying to counteract the effects of the destructive forces by establishing a new equilibrium. Hence large forces acting quickly are less destructive than many small forces acting more or less continuously, the reaction in the latter case not having completed its cycle before its effects are required in another direction, as it were. In other words the metal has not had time to come to rest, the first reaction being diminished by the second one following. If, then, the metal is in good structural and thermal condition the plasticity will permit uniformity of flow, while the uniformity of the structure, uniformity as to size of crystals and uniformity of the nature of each individual crystal, will permit uninterrupted transmission of the elasticity throughout the mass of crystals with consequent uniform reaction producing a detail fracture, if fracture does take place, of the kind shown in Figs. 1 and 2.

If, however, slag inclosures prevent close cohesion of the crystals in any part of the cross-section of the structure, or if the center of the ingot is spongy, producing similar effects, or if segregation should produce a variety of physical conditions of the crystals in size and chemical composition, or if thermal conditions have induced internal stresses with consequent unstableness and unpreparedness for resisting extraneous destructive forces, there will be different degrees of plasticity in different parts of the structure, the flow of the metal caused by shock and pressure will be irregular and jerky, as a consequence of which there will be impaired transmission of the elastic wave, and the intensity of elasticity will vary in different parts of the metal counteracting each other, while elastic reaction can assert itself but imperfectly, if at all. It is obvious that under such circumstances and conditions the separation of the crystals will take place in a variety of form and manners, altered, or modified by the nature of the forces trying to destroy the structure, with any chance condition influencing the final result. Thus we perceive why and how the appearance of the fracture is an indication of the treatment of the steel in the mill, the frequency of internal fissures in rails and their similarity in form pointing to an unstable thermal condition and not to overloading. If overloaded with good conditions of steel a true detail fracture would result.

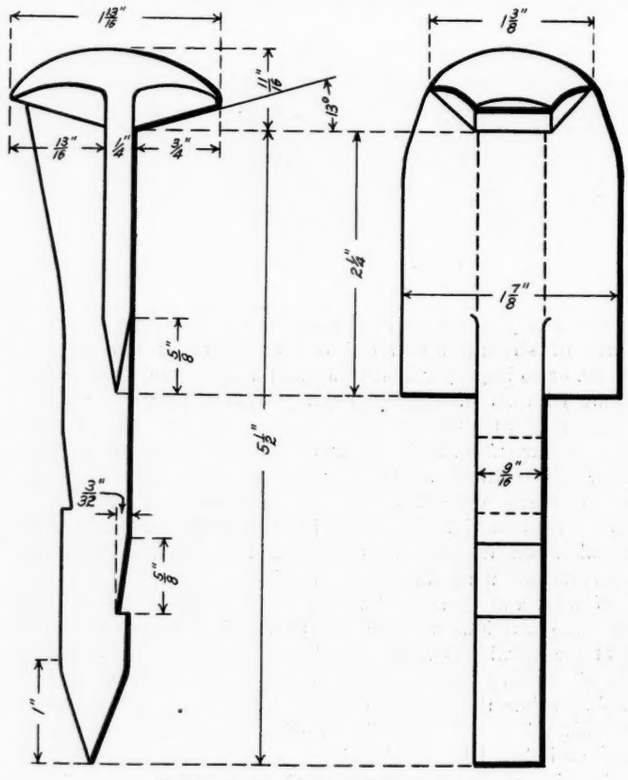
ARGENTINE RAILWAY EMPLOYEES' PENSIONS.—A press report states that the Argentine Chamber of Deputies now has under consideration legislation relating to pensions for railway employees. The nature of this legislation is not given out in the report, but it is stated that representatives of the Great Southern, the Buenos Ayres Western, the Argentine, the Central Argentine and the Pacific Railway companies have visited the vice-president of the republic to present a petition asking the government to withhold its immediate sanction to the law. The railway representatives referred to the unsatisfactory economic situation now prevailing, and to the heavy decline in freight receipts experienced by most of the companies. The vice-president has replied that the government has already communicated its favorable opinion as to the proposed law, but he has promised to consult with the minister of public works regarding the present petition.

A NEW TRACK SPIKE

The "safety" track spike, designed to present a greater resistance to side thrust and vertical pull than the ordinary spike, has received a maximum test of nearly one year and is now being tried by a number of important roads, including the Chesapeake & Ohio, the Richmond, Fredericksburg & Potomac, the Seaboard Air Line, the Carolina, Clinchfield & Ohio, and the New York, New Haven & Hartford.

The distinguishing features of this spike are the two projecting wings on the sides of the body to increase its resisting power to the lateral movement of the rail, and the notches on the front and back edges below the wings to increase its resistance to an upward pull. It is stated that the displacement of fiber by this spike is only .012 cu. in. greater than that of the ordinary track spike, and that the resistance to lateral movement is increased more than 300 per cent.

The new spike is made of low carbon steel, ranging from .12 to .20 per cent of carbon, and having a tensile strength of 5,500 to 6,500 lb. per sq. in. The spikes are made by the drop forge process, giving uniform strength, particularly at the throat where the common spike is apt to be weak on account of its



A Sketch of the Safety Track Spike

manufacture by the upsetting process. The throat is reinforced by additional metal on the back just under the head, giving it added strength when reversed to be used in the slot of an anglebar.

It is thought that the advantages of the new spike will be most fully realized on curves and at switches where rail spreading is most common. It is declared that the use of these spikes will allow rail-braces to be eliminated at such points, saving the cost of these devices and reducing the number of spikes about 60 per cent. The spike can be applied with a maul and pulled with a clawbar, in the same manner as an ordinary spike.

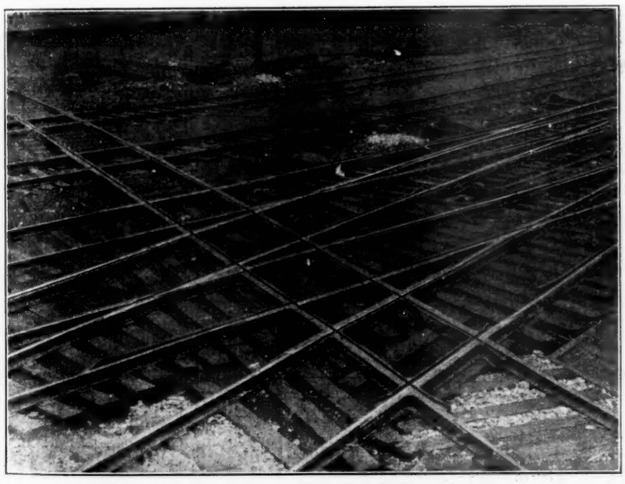
A special tie plate has been designed, also, by the Railway Safety Spike Company, Richmond, Va., which is placing the new spike on the market, for use with those spikes if tie plates are desired on curves. The punching in this plate is designed

to allow the use of the new spikes with five different sections of rails between 80 lb. and 100 lb.

The Richmond, Fredericksburg & Potomac placed a keg of these spikes in its track on a 4 deg. curve with a grade of 0.5 per cent, on its James River branch, in September, 1913. The track is laid with 85-lb. rail and carries a heavy traffic. With rail-braces on this curve, it had previously been necessary to regage the track once or twice a year. Up to the present time the new spikes have held the track to true gage without special attention from the maintenance force. The test on the Seaboard Air Line is being made in the Brown street yard, in Richmond, Va., on a 7 deg. curve near a water tank, where the ties are wet and the rails are therefore more likely to spread. Although tie plates and three ordinary spikes have failed to hold this track to gage, the two safety spikes have held the rails to proper gage for seven months. Tests on other roads are also proving satisfactory, although they are not of sufficient length to furnish absolute proof as yet.

A COMPLICATED CROSSING RENEWAL

It was recently necessary to renew a set of crossings known as the Chattanooga Belt Railway crossings at the East End avenue entrance to the Chattanooga passenger station without interference with a very heavy and almost continuous movement over these crossings. Because of a back-up movement, all passenger trains of the Alabama Great Southern and of the Memphis division of the Southern approaching or leaving the station, pass over these crossings twice. The passenger trains of the N. C. & St. L., the C. N. O. & T. P., the Chattanooga Southern, and the Knoxville and Atlanta divisions of the Southern also pass over these crossings in going to or from the station, while all passenger locomotives have two additional movements over these crossings in going to or from their respective engine houses. With the additional freight and switching business there is an average of 400 movements over these crossings daily.



The Four Crossings (in the Foreground) After Renewal

The renewal of this crossing was made by the C. N. O. & T. P., on which road considerable study has been given to the subject of the drainage and proper foundations for crossings. The method of procedure in this regard at this point conforms to the general practice of this road.

In renewing the crossings the foundation was first removed around the old ties, and they were blocked up just enough to insure safety to trains operating under slow orders. The old ties were then replaced with new ones, one at a time, and spiked sufficiently to maintain the correct gage of the track. The four crossings were then replaced, one at a time, with 85 lb. solid manganese crossings. After the new crossings were in place and were surfaced up on blocks, a foundation consisting of iron borings mixed with sal-ammoniac, was placed under and around the new ties and well tamped. This "rust bed," as this foundation is termed, extends 6 in. below the base of the ties, and is brought up to about the level of their upper surfaces, giving a solid block 14 in. in thickness, and extending to the ends of the ties for the full length of the crossing.

This type of foundation eliminates water pockets and reduces the noise, while at the same time it does not give as rigid a foundation as concrete, thereby decreasing the impact of wheels, and increasing the life of the crossing. Actual experience at other crossings has shown that the frog points do not wear down any more rapidly here than on ballasted foundations. When it becomes necessary to renew a crossing on this foundation, all that is required is to loosen and remove the "rust bed" sufficiently so that the tie can be turned at a slight angle and lifted out, the track having, of course, first been raised slightly on track jacks. By inserting ties of the same dimensions the "rust bed" proper is then left undisturbed.

OPERATION OF A GRAVEL PIT*

By H. O. Whitney

Roadmaster, Canadian Pacific, Medicine Hat, Alta.

There is no way that money can be wasted or saved faster in the maintenance of way department than in work train service. The high wages paid train and engine men, the mechanical charges and fuel and other expenses connected with the present day work train, all contribute to the opportunity for efficient management. Where in service for any length of time, the principal uses of work trains are in gravel or dirt moving service, and such work affords a greater opportunity for proper planning and organization than where work trains are put on for a short period to do odd jobs.

Before work trains are started the roadmaster usually knows just what work he is to do, the amount of money allowed and the equipment he can expect to receive. If traffic is heavy he cannot expect to secure the best power and he has to be satisfied with what he can get. However, this can be overcome to a certain extent by a little personal talk with the master mechanic. An explanation of the conditions and length of haul, the class of equipment to be used and other details will help him to assign the best available power for those conditions. And last, but not least, he should confer with the master mechanic about assigning good engineers, firemen and watchmen to these positions. An engineer who can keep his engine in shape for a week or two without seeing the roundhouse and who is always ready to go when he receives signals or orders and a willing fireman contribute a large share to successful work.

It is a practice on some roads to appoint a trainmaster to work train service exclusively where there are a number of these trains in service, but on the average work this does not apply. If there is no work train trainmaster appointed it is well to confer with the regular trainmaster regarding the assignment of crews and it is a good practice to ask him to come out on the work for a few days when starting. A good conductor in charge of each train is absolutely necessary. I have found that it works out well to appoint the oldest experienced conductor pit foreman with full charge over all crews in the pit and giving him a small gang of men in charge of a good foreman to look after pit tracks, coal engines, assist car repairers and do any odd jobs around the pit.

Never start work trains until the equipment is collected and in shape for service unless it is absolutely unavoidable. To start with half enough cars not properly equipped not only means high cost on the start but often will be the cause of poor equip-

*Received in the contest on The Proper Handling of Work Trains which closed December 27, 1913.

ment for the whole season. Cars, plows, Lidgerwoods, spreaders and other equipment should be collected and put in condition before the work starts. With a plant in first class shape good work can be done from the start and running repairs can be kept up.

The pit staff should have two or more car repairers, one of whom should act as inspector and all equipment should be kept in good repair, to save long delays on the road. I have always kept a blacksmith and a forge in a pit and have found plenty of work to keep them busy. The foreman in charge of tracks should have a sufficient gang to keep the tracks and switches in condition, as a derailment in a pit means delays, not only to the pit train but to all trains dependent on its output. I have always made it a practice to lay tracks behind a steam shovel, instead of throwing the old loading track, when the shovel is ready to move back, thereby avoiding all delays to work trains and also always having a strong track. The ordinary gang in the pit lays this track each day as the shovel moves ahead, thereby making it unnecessary to move in an extra gang for this work.

Besides loading tracks pits should have a long storage track for loads and one for empties to avoid any delays to hauling crews. Considerable delay is often caused through coaling engines in districts where no coal shutes are available. I have made it a point to build a short depressed track in pits and stand engines there at night when tied up giving them a full tank of coal. Keeping a car or two of coal at convenient points on the road where engines can fill up while waiting to meet trains or while engine crews are eating will practically avoid delays from this cause.

If a cable gang is necessary the best foreman available should be in charge and his gang should be picked men. A foreman must see that his unloading equipment is always in shape and must be ready to unload day or night. He should know beforehand just where ballast or dirt is wanted and in what quantities, leaving his finishing work for daylight unloading. A good foreman can save many delays by watching trains and not allowing them to become bunched up.

THE LAWRENCE SNOW AND ICE FLANGER AND BALLAST SPREADER

As its name indicates, the Lawrence snow and ice flanger and ballast spreader is designed for use either as a flanger for removing snow and ice from the track in the winter or for widening the shoulder of the roadbed and spreading ballast in the summer. It consists of two blades designed to remove the snow or ballast to the desired level and by means of the side wings to push it out onto the shoulder. Although only one set of wings is shown in the accompanying photograph, the cars are now built with two complete sets of wings so that they may be operated in either direction.

The Lawrence Snow Flanger and Ballast Spreader with Blades Lowered Ready for Action

The flanger blades with their raising and lowering mechanism can be mounted on any car of suitable construction, either open or closed. The flanger blades are curved similar to an ordinary plow so that when lowered in position for operation the edges project under the snow or ballast, lifting it and crowding it outside the track. The blades are provided with removable flanger tips which can be renewed when worn. They are so designed that they are free to recede backward and upward if they should strike a frog, crossing or other obstruction, dropping back to the normal position after passing the obstruction. When flanging ice or leveling heavy ballast material, the blades can be held rigidly in their lower operating position by the application of air through a four-way valve if desired. It is claimed for this device that it is cheap in construction while it is durable and the cost of maintenance is small; its combined use enables it to be used throughout the entire year; it can be run in either direction and it is operated by air taken from the train line without interference with the brakes, thereby eliminating extra connections on the engine.

View Showing the Condition of the Track After Leveling Heavy Ballast with the Lawrence Spreader

This car has been used on the South Buffalo Railway for the past three years, during which time it has been given severe tests. It has not been necessary to use a snow plow on the tracks of this road at any time during this interval. It has also cleared the ash pit tracks of ice and frozen cinders, while it has spread five cars of heavy ballast on a track in less than five minutes. One of the accompanying photographs shows a track cleared of heavy brickbats with this spreader. It has been designed by the B. F. Lawrence Co., Buffalo, N. Y.

A METALLIC TAPE THREADER

The Lufkin Rule Company, Saginaw, Mich., has just put out a patented measuring tape attachment known as a "threader," which will hereafter be furnished with its "metallic" woven tapes without extra charge.

The "threader" is a loop and stud arrangement, by means of which the tape, though securely fastened to the winding drum of the case when in use, can be readily detached from it and a new tape as readily attached, without manipulation of the case, case screw or drum.

Woven tapes are sometimes torn by accident or through long use often become soiled and worn in such a way that they must be replaced while the case is yet in very fair condition. As the case represents approximately half the value of the outfit it is of considerable importance that it be possible for any one to insert a new tape in the old case as often as necessary, and thus get the fullest measure of use out of the case as well as the tape. Metallic tapes without cases are quite generally kept in stock by hardware stores, etc., and can always be easily obtained.

Convention of Bridge and Building Association

Abstract of Committee Reports and Discussions at Twenty-fourth Annual Meeting at Los Angeles, Cal.

The twenty-fourth annual convention of the American Railway Bridge and Building Association was held at the hotel Alexandria, Los Angeles, Cal., October 20-22. A special train was run over the Santa Fe from Chicago to Los Angeles to carry members and guests to the convention. This train brought nearly 100 and the total registration was 140 members. The officers for the past year were: President, J. N. Penwell, Lake Erie & Western, Tipton, Ind.; first vice-president, L. D. Hadwen, Chicago, Milwaukee & St. Paul, Chicago; second vice-president, G. Aldrich, New York, New Haven & Hartford, Boston, Mass.; third vice-president, G. W. Rear, Southern Pacific, San Francisco, Cal.; fourth vice-president, C. E. Smith, Missouri Pacific, St. Louis, Mo.; secretary, C. A. Lichty, Chicago & North Western, Chicago; treasurer, J. P. Canty, Boston & Maine, Boston, Mass.

OPENING BUSINESS.

President Penwell called the convention to order at 10 o'clock Tuesday morning.

Reverend Charles Edward Locke opened the sessions with prayer. The convention was welcomed to Los Angeles by H. V. Platt, assistant general manager of the Southern Pacific, and W. H. Whalen, division superintendent of the Southern Pacific; and Vice-President Hadwen responded for the association. The reports of the secretary and treasurer were then read and showed a balance of $1,100 and a membership of over 600. The secretary, in addition, reported 38 new members.

The committee reports and discussions presented at the business sessions follow:

ICE HOUSES

The type of construction that can economically be adopted for ice houses depends on the cost of construction, maintenance and operation of the house and on the loss suffered through shrinkage of the ice. The percentage of shrinkage in stored ice is dependent on the efficiency of the insulation of the house and can be reduced, but not entirely eliminated. In some cases it has been considered sufficient to store ice directly on the ground and build four walls and a roof over it, decreasing the shrinkage by covering the ice with hay, sawdust, or similar material. The loss suffered by such practice depends on the cost and supply of ice and the condition of its use. The cheapest type of construction may suffice at northerly points immediately adjoining large lakes that freeze over every winter where the cost of ice is very small, while in hot southern countries where natural ice must be hauled in during the winter or artificial ice manufactured at all times, very expensive types of construction are justified.

The problem of providing better insulation cannot be solved by merely changing from a wood frame to brick or concrete construction, for in either case insulation must be provided. When it is considered that brick and concrete houses cost from $4 to $6 per ton of ice storage capacity, as compared with $2 to $3 per ton for well constructed and insulated wooden houses, it is questionable if under all conditions the more expensive type of construction is justified. At the present time the wood frame house is used almost universally.

A feature that has been given but slight consideration is the insulation of the floor. A great majority of designers have thought that it would be sufficient to level off the ground and place the ice directly upon it, sometimes covering the surface with cinders, boards or concrete. Heavy losses due to shrinkage at the floor line in a number of houses indicate that the stored ice will not overcome the ground heat which continually rises to the surface and melts the ice. In more recent houses the shrinkage from this cause has been largely reduced by providing air spaces between the ice and the ground usually by placing joists and covering them with a slat floor for the support of the ice. These air spaces are from 6 in. to 12 in. deep.

The foundation for the walls can be of the usual types, including concrete, brick, wood blocking, posts, and pile studs. Especially where masonry foundations are used, care must be taken to secure proper insulation. In porous soil the water from the melted ice is permitted to go directly into the ground, but at other points drains must be installed. Such drains must be trapped to prevent air currents entering the house through them. The air entering a room through a 4-in. pipe can easily melt 1,000 tons of ice in a single season.

Ice storage rooms vary in capacity from 50 to 1,500 tons, the average being about 1,000 tons. The usual dimensions are 30 ft. wide, 40 ft. deep and 30 ft. high. Although many different arrangements, thicknesses and designs of wall construction are used, the general trend is towards vertical studs 6 in. to 12 in. wide, covered on both sides with wood sheeting, building paper, etc. The best construction requires double sheeting inside and out, with waterproof building paper between the layers, the spaces between the sheeting from stud to stud being filled with insulating material.

Air spaces have been considered to afford excellent insulation, but it is necessary to prevent circulation in the air space to secure the best results. This can be done by proper framing to cut such spaces into smaller spaces or by filling them with suitable porous insulating material which will fill the space but yet leave the greater part of it, consisting of pores in the material, full of air so separated as to prevent circulation. The sawdust and ground cork which have been largely used to fill these spaces decay rapidly on account of the continual dampness and start decay in the timber walls. At present various materials are used which are specially treated and manufactured for this purpose, principally from flax, cork and limestone. Flax is made up into blankets enclosed by sheets of waterproof paper. Cork is made up into cakes pressed together and cemented with asphaltum or other waterproof cement. Limestone is heated to 3,500 deg. and when liquefied is blown into shreds, making a sort of rock wool, enclosing a large percentage of air bubbles. Partitions are insulated somewhat similar to the walls, but, as the difference in temperature on the two sizes is not so great, the same care is not justified.

The two principal objections to wood frame ice houses are the danger of fire and the decay of the timber. As timber lends itself well to ice house construction, safety against fire can be obtained by covering the exterior walls with expanded metal and stucco and covering the roof with a fireproof material. Any openings into which birds might enter and build their nests should be covered with a galvanized iron mesh. Decay can be postponed for many years by treating the timber.

There is very little difference in the types of roofs used. Steel trusses are seldom or never used on account of the rapid corrosion that would result from the dampness. Wooden trusses are usually so built that the roof covering can be applied to the top chords, while the ceiling for the ice chambers can be applied to the bottom chords. This affords an air chamber between the roof and the ceiling of the house through which air can circulate, resulting in a good insulating air cushion. The height of this attic space is usually not less than 3 ft. and varies up to 8 or 10 ft., as in some cases machinery is located in this space. The insulation of the ceiling must be just as effective as that of the walls and practically the same type of construction is used. Great care must be taken at the connections of the walls

to the foundation, and also of the ceiling to the walls and partitions in order that no opening will be left through which air can enter.

The doors are usually of ordinary refrigerator construction with several sections separated by air spaces which are sometimes filled with insulating material. In some houses the doors extend vertically from the top to the bottom of the house in each chamber, although in such construction there is more likelihood of the entrance of warm air and greater difficulty in keeping the joints between the doors tight.

In storing the ice the individual rooms should be filled entirely between walls with ice laid in contact and filled up as close to the ceiling as possible. It is necessary to use some means to keep the ice apart in order that the cakes will not melt together. The former practice of using sawdust to fill all crevices has practically been abandoned on account of the shrinkage resulting when the ice is washed. Recent experiments have been tried in the use of waterproof paper to separate the layers of ice, which effectually prevent the cakes from freezing together and also prevent the circulation of air between layers. When ice must be stored for many months for rapid use when demand arises, it is well to cover it with a thick layer of some insulating material such as hay or straw.

The length and width of the platform for handling ice between the cars and the house depend upon the requirements, but as a rule when conveyors are not used and ice is handled in buggies, a platform 16 ft. wide will be found very convenient, although narrower platforms have been successfully operated. Where a comparatively small number of cars are iced, short platforms are sometimes built in front of the house, long enough to accommodate 5 to 10 cars, a switch engine being required to handle the cars when there are more than can be placed at one time. Where many trains require icing, it is of considerable advantage to have an icing platform the full length of the train, so that it can be iced at one spotting, especially at engine terminals where such trains do not need to be broken up otherwise. Where many trains have to be iced and the platforms are long, it is of advantage to use continuous platform conveyors to carry the ice from in front of the house to the point where it is put in the cars. The report included abstracts from replies received from a number of railways, detailing at considerable length, the practice in the construction and operation of ice houses.

Committee: C. E. Smith (Mo. Pac.), chairman; A. Ridgway (D. & R. G.), W. A. Pettis (N. Y. C. & H. R.), G. A. Manthey (M. St. P. & S. S. M.), G. S. Kibbey (M. & St. L.), and J. F. Parker (A. T. & S. F.).

This report was accepted without discussion.

WARNINGS FOR OVERHEAD AND SIDE OBSTRUCTIONS

There is no doubt as to the necessity and value of giving warning to men on the top and sides of cars when a train is approaching some structure or tunnel with less than the requisite clearance. In general, some appliance is suspended or swung across the track near the obstruction so as to strike the man a light blow and thereby warn him. Different systems are employed to accomplish this end. The one in most extensive use, known as the vertical rope system, consists of light ropes or wires known as tell-tales, whipcords, ticklers or danglers, suspended over the track from a rigid horizontal wooden or iron bar, or a flexible wire or cable, the latter being suitably supported on the outside of the track by upright posts set in the ground and properly braced and back-stayed. For single track an arm is extended from a counterweighted or braced post and the same style of warning can be used. The ropes are generally spaced from 3 to 10 in. apart for a distance of 5 to 8 ft. across each track, the lower end being about 6 in. below the lowest point of the overhead structures for which they are to give warning.

One of the important essentials is to prevent the rope from becoming entangled or thrown over the support by the wind, engine exhaust, or more particularly, by the trainmen when a car is temporarily stopped under the warning. The warning should not be too far from the structure, certainly not more than 200 ft., and in yards where much switching is done immediately under the structure, the location should be closer, probably 100 to 150 ft. The warnings should be used at all overhead obstructions with clearance less than 21 ft. The advantage of using a cable is that it can span a number of tracks, but it has the disadvantage that it is liable to sag and require a good truss cable with turnbuckles so that it can be tightened up from the ground. The post requires good back-staying or else must be made strong enough to avoid the necessity of a back-stay. In many locations there is not sufficient room to use stays.

It is also important from a maintenance standpoint to arrange the drops so that they can be repaired easily if torn off, tied up or otherwise damaged. A number of roads use galvanized wire screens from which are suspended wire or rope drops. Although this is a good warning, it is expensive to maintain on account of the rusting of the screen. Wire drops are sometimes used, but are very easily bent, making them dangerous. Iron rods are also used, to which rope drops are attached, the latter being not longer than the rods to prevent their catching and hanging over the top of the cable or crossarm.

The committee believes the vertical rope system to be the best under most circumstances and recommends its adoption for general use. Where two or more tracks are to be spanned, steel poles not less than 8 in. in diameter at the bottom and 5 in. at the top, set in a concrete base, should be used. The supporting cable of 3/8-in. solid copper, copper covered pliable steel (six-strand) or galvanized wire rope, should span between these poles at a height of not less than 21 ft. Wooden heads should be fastened to the cable with hanger clamps. On the lower side of these heads, dished washers should be provided, held in place by eye-bolts, to which are attached 1/4-in. rods. The washers prevent the drops from being thrown over the top of the truss cable. To the lower end of the rods can be fastened 1/2-in. or 5/8-in. manila rope drops, the length of which is governed by the least clearance of the obstruction. The truss cable should be supported by saddle caps on top of the poles and should extend down the back side of the pole to a point about 5 ft. above the ground and there attached to a turnbuckle fastened to the pole by means of a clamp. This allows the truss cable to be tightened while standing on the ground.

The approximate cost of a warning for one approach over four tracks is $127 for material, $48 for labor, or a total of $175. For single track the same style of pole may be used by having a longer wooden head and a 2-in. wrought iron pipe for a brace. The approximate cost of such a warning for one approach is $58 for material, $28 for labor, or a total of $86.

For side clearance warnings, several roads use an iron post to which are fastened a number of wooden blades with rubber ticklers on the ends. These blades are fastened to a rod which is operated by springs on both sides so that when struck it will swing either way and come back to the proper position. Another style of side warning consists of an iron post around which is fastened several rings of rubber garden hose, forming a cylinder about 3 ft. in diameter which is free to revolve when it is hit.

The report included detailed descriptions of the warnings used on a number of roads, with drawings and prices.

Committee: E. G. Storck (P. & R.), chairman; F. E. Schall (L. V.), T. E. Thomas (B. & O.), M. M. Barton (P. R. R.).

Discussion

G. Aldrich (N. Y., N. H. & H.) stated that his road used tarred rope instead of plain manila rope for telltales, as it lasted longer. F. A. Taylor (B. & O.) urged the placing of the turnbuckle up out of reach of mischievous boys. E. G. Storck (P. & R.) stated that he places turnbuckles in reach of men on the ground and sends two men to tighten them every two weeks. He also said that he finds low turnbuckles more convenient and has had no trouble. F. E. Schall (L. V.) suggested placing a

small sheet iron box with a key over the turnbuckle. C. W. Richey (Penn.) stated that he has several hundred such warnings and likewise has found no trouble. He criticised the side warning proposed in the report as being almost as dangerous as an obstruction. A. S. Markley (C. & E. I.) has tried rattan strips, but was unable to keep them from warping. The committee was continued another year and instructed to pay special attention to side clearances and to tabulate the present requirements of the various states.

REINFORCED CONCRETE BRIDGES

The committee canvassed the railways of the United States and Canada to determine to what extent reinforced concrete is used for bridges, the types developed and in most general use and the practice of different roads regarding standard types and specifications for designs. The accompanying table shows a brief summary of the results of this canvass. It is likely that if full information could be had an even larger proportion of roads would be found on which reinforced concrete is not in use, as some of the roads failed to send in reports because they had no structures of this kind.

The two types of structure most in favor are the box culvert and the deck slab. On two large systems the deck slab is the only type of reinforced structure in use. Following these are the retaining wall and the trestle. These four leading types are far ahead of any of the others in the number of roads on which they are used and in the mileage of those roads. If measured by the total aggregate of structures, their lead over the other types would probably be even greater. For instance, the C. M. & St. P. alone has approximately seven miles of the deck slab on a single track basis.

	TYPES OF REINFORCED CONCRETE STRUCTURES IN USE									
	ARCHES BARREL TYPE	CULVERTS (RECT. BOX TYPE)	CULVERTS (ARCH TYPE)	ABUTMENTS SOLID	ABUTMENTS (HOLLOW BACK)	PIERS	TRESTLES	DECK SLABS	RETAINING WALLS	CITY SUBWAYS
Number of Roads on which type is reported in use.	16	30	15	18	13	15	17	28	23	15
Mileage of Roads on which type is reported in use.	61270	106972	48559	67580	52992	55932	76808	104776	81120	10864
Total number of Roads reported										54
Total mileage of Roads reported										163 449
Number of Roads reporting no reinforced concrete structures										13
Mileage of Roads reporting no reinforced concrete structures										24664

Tabulation Showing Use of Reinforced Concrete Structures

There is a considerable diversity among the roads in specifications, design and details of practically every type in use. On only a few points is there anything like uniformity. A 1:2:4 mixture and a moduli ratio of 15 appear to be quite generally accepted as correct for fully reinforced structures.

Three types of reinforcing bars are in quite general use, plain round bars, square bars straight and twisted, and deformed bars. Many roads use all three types, the latter two being generally preferred to the plain round bars. Unit systems of reinforcement appear to be very little used for railroad bridge work as none of the reports showed this type in use. There are marked differences in the arrangement of the bars in the structures and this is apparently due more to methods of construction than design. Some roads use only straight bars, or bars simply with short bends at the end, while others do not hesitate to use bars with four to six bends. It is quite generally accepted that bent bars if made true to form and properly placed in the structure will fulfil the requirements of design better than a combination of straight bars. There are, however, other considerations that enter into the selection of reinforcement, such as methods of handling, shipping and placing bars, facilities for bending bars in the field and the skill and training of the men on the work. Manifestly a road with a good organization of well trained foremen and men and ample facilities for bending and handling bars would be less restricted in the type of reinforcement than a road dependent on contractors or with a less effective organization of its own. Only one road reported that it includes re-rolled deformed bars in its specifications and added that none has been used because they have never yet been available.

A considerable variation exists in the allowable working stresses of both steel and concrete which cannot be fully accounted for by the differences in the materials used in the concrete and to the impact allowances in the load. They must be attributed in part to the confidence, or lack of it, that designing engineers have in the strength of the material and in their ability to analyze the conditions of the structure under load. It is not to be expected that the working stresses for reinforced concrete can be brought even near the uniformity that obtains in the working stresses specified for steel structures and the uncertainties in both analysis and construction can best be covered by a liberal excess of strength in the design.

Tests recently conducted at the Engineering Experiment Station of the University of Illinois, and published in Bulletin No. 71, covering the strength of the bond between concrete and steel, show a very creditable record for the plain round bars. The bond resistance per unit of surface for square twisted bars was only 88 per cent of that developed by plain round bars. If the cross section of the bar be made the basis of comparison, it will be found that the square twisted bars developed practically the same bond resistance as round bars of the equivalent section. In the light of these tests it is concluded that, "the results found with the twisted square bar does not justify its present popularity as a reinforcing material." These tests also prove that under ordinary laboratory conditions the deformed bar is no more efficient in developing bond resistance than the plain round bar. However, the fact should not be overlooked that vibration, which is so large an element in working conditions, could not enter into the results of these laboratory tests. The designing engineers may feel that the deformed bar offers a security against vibration and against initial failures that fully justifies its use in spite of the excellent showing made by the plain round bar in the laboratory test.

Committee: O. F. Dalstrom (C. & N. W.), chairman; I. L. Simmons (C. R. I. & P.), L. D. Hadwen (C. M. & St. P.), J. A. Bohland (G. N.), A. Montzheimer (E. J. & E.), C. J. Scribner (C. B. & Q.), and D. C. Zook (P. L. W.).

Discussion

In a letter O. F. Dalstrom (C. & N. W.) called attention to the wide variation in the specifications for reinforcing steel ranging from soft rivet steel to high carbon steel.

CARE OF HIGHWAY TRAFFIC WHILE CONSTRUCTING BRIDGES TO ELIMINATE GRADE CROSSINGS.

When the volume of traffic on a railway requires more than two tracks, the ordinary safeguards at grade crossings are inadequate and in order to reduce the menace to safety it is necessary to eliminate the grade crossing. In many cases early railroad promoters and locating engineers selected lines which would allow grade crossings in preference to over or under crossings. As much as such locations may be regretted at present when contemplating the cost for eliminating grade crossings, it must be recognized that such construction was necessary in the start in order to secure a development of traffic which will today produce income sufficient to pay for the elimination of these grade crossings.

The high value of land in cities is in the majority of cases the ruling consideration in the method to be adopted when planning to eliminate grade crossings. Under such circumstances it is frequently necessary to build trestles or retaining walls with solid filling between the walls in addition to the bridges required at street crossings. The performance of construction work and the maintenance of traffic within such restricted limits create involved problems for the solution of which it is necessary to have an intelligent plan well studied and worked out in advance and a well organized and properly directed working force equipped with all necessary machinery

and appliances. The continuance of regular traffic necessarily increases the difficulties of accomplishing the work and it should be considered in planning such work that sufficient money must be provided to pay for the increases above ordinary unit costs.

As an illustration of the method used in handling traffic in a complicated problem of eliminating grade crossings, the chairman describes the work on the Boston division of the New York, New Haven & Hartford, performed in 1910-11, with which he was familiar. This work consisted of eliminating 10 crossings in a thickly populated section of Boston on the Third district between Savin Hill and Neponset on the main line and between Harrison Square and Field's Corner on the Shawmut branch. The train service on these lines was very frequent, the main line handling as many as 133 passenger trains and 9 freight trains in each direction in 24 hours with occasional extras. The construction service required the following trains: One train for shifting and delivering of material to contractors, one for the extra gang on track work and three gravel trains for hauling filling material for a distance of about 11.5 miles. Two of these gravel trains were worked day and night for a period of about three months, hauling a total of 611,000 cu. yd. of filling.

The control of all gravel and construction trains was placed in the hands of a traveling yardmaster who assigned their work and saw to it that all work trains were properly employed and also were kept within safe limits. Engineers, contractors, supervisors and construction foremen explained their needs to this traveling yardmaster when switching service was desired. Work trains were not allowed on the main track at the scheduled time of any first-class train. On this account no work trains could use the northbound main track from 7 to 9 a. m., nor the southbound main track from 4 to 6 p. m., the period when trains to and from the city were most frequent. Work trains were given rights on the main track up to the scheduled time of second-class trains by faithful and proper protection with flags or lanterns, according to the book of rules.

A complete set of standard signals was installed for all tracks used as main track in each temporary location as well as for permanent tracks and all switches in main line track were protected by mechanical interlocking plants.

On the main line the general plan adopted was to keep two main tracks for regular traffic at all times. In the first temporary position the two tracks were laid on the original low grade as near the west property line as practicable, leaving the east portion of the right of way available for the construction of one new track at the new elevated grade and for the widening of the elevated roadbed for a second track, the building of one-half of the length of each of the masonry bridge abutments and the placing of the steel work of bridges for two tracks on these abutments. As the bridges were plate girders in all cases, the second half of these bridges could be added with economy and convenience. The steel bridge work on the main line was erected on tracks which did not have regular traffic on them at the time, an advantage of no mean importance in the cost of the work. When the two tracks on the new high grade were available, regular main line traffic was turned over them and the two tracks in the first temporary position on the low grade were abandoned to allow filling, masonry and bridge work to be completed at the new high grade on the west side, completing the work for a four-track permanent roadbed for the entire distance.

On the branch line, regular traffic in both directions was handled over a single track during construction work. At the first temporary move the northerly track was continued in service at the original level, making the southerly part of the right of way available for the construction of one track on the new high level. A timber trestle was required to support this track for a considerable length, as the right of way width was too narrow to allow earth filling to be made at first. The narrowest width, 30 ft., was near the street which had the greatest volume of traffic, and as the adjoining property was so closely built over and so valuable that it was not economical to purchase land for widening the right of way, it was necessary to place niches in the back of the south retaining wall to receive bents of the temporary trestle which supported the track at a high grade.

The highways which were crossed at grade by any of the tracks, temporary or permanent, were protected at all times by lawful safety appliances. The crossing signs and gates were maintained and the latter operated for the full 24 hours. At the passenger stations, proper platforms were always kept available for the use of patrons. It was necessary at times to have temporary platforms at different stages of the work, and while the temporary buildings were not always up to the track level, they were safely accessible to the platforms, and none of them remained below grade for any great length of time.

W. F. Strouse, assistant engineer, Baltimore & Ohio, presented a discussion of the method used on that road for handling such work. In building a 30-ft. concrete arch, the tracks were carried on pile bents until the excavation was finished and the masonry work completed to the elevation of the springing line of the arch. The bents were then cut down, and plate girder spans of 64 and 66 ft., respectively, were substituted for the purpose of carrying the traffic while building the arch proper. As soon as the masonry was finished the space below the girders was back filled with cinders and other suitable material to approximately the under side of the girders. Cinders were then dragged out upon the track, filling the space to approximately the base of the rails. When the concrete was sufficiently hard, the girders were lifted out with wrecking cranes, one at each end, after which the track was restored and additional cinders added. Both girders were removed the same day, the traffic on each track being cut out for a period of about two hours.

In constructing abutments for supporting steel girders, the piles are driven first, then the street is depressed, bracing being applied as this work progresses. This method, of course, cannot be utilized where rock is encountered above the foundation line. In cases of this kind it is customary to support the tracks by excavating trenches to the elevation of rock, in which timber bents are placed with the necessary stringers to carry traffic while removing the rock to a lower level. The new timber bents are then placed before the removal of the other bents for the purpose of removing the rock under the same. This process is repeated until the material is removed to the proper elevation. When possible, of course, detour lines are built to avoid the necessity of expensive trestle work.

Committee: G. T. Sampson (N. Y., N. H., & H.), chairman; R. H. Reid (L. S. & M. S.), J. P. Canty (B. & M.), W. F. Strouse (B. & O.), F. E. King (C. M. & St. P.), W. H. Wilkinson (Erie), H. V. Smith (W. & L. E.), and E. N. Layfield.

The report was accepted without discussion.

WATER PIPE.

Cast iron pipe is preferable to either wrought iron or steel pipe for underground water mains because of its greater resistance to corrosion. There are considerable data which go to show that cast iron pipe is good for 100 years when properly coated under almost any soil conditions. The following table gives the approximate cost of laying pipe, as determined by actual railroad practice:

Diameter of pipe.....	4 in.	6 in.	8 in.	10 in.	12 in.	14 in.
Pipe at $30 per ton.....	$0.36	$0.54	$0.78	$1.06	$1.38	$1.53
Yarn at $0.07 per lb....	.0012	.002	.003	.0035	.004	.005
Lead at $0.05 per lb.....	.031	.0425	.05	.07	.08	.09
Loading and handling...	.01	.015	.02	.025	.03	.04
Trenching and refilling (4 ft. cover).....	.11	.15	.16	.18	.20	.22
Laying, caulking, etc....	.05	.07	.10	.12	.15	.17
Total per lin. ft....	$0.56	$0.82	$1.11	$1.46	$1.84	$2.06

The above figures are based on class "C" pipe for a 300-ft. head and 130-lb. pressure, with the exception of the 14-in. pipe, which is class "B" for a 200-ft. head and 86-lb. pressure. Pipe of this size is usually installed only for penstock lines with a comparatively low head.

Joints in cast iron pipe may be made with lead, cement, lead-

ite, lead wool, or rust. In making a lead joint the packing should be twisted to form a rope a trifle larger than the joint space and cut so that the ends will meet when driven home. Care should be taken that the packing is driven up evenly so that a uniform lead space of about one-third the length of the bell is left. Tarred jute can be driven tighter than plain packing, but as it is much harder to handle, the latter is usually given the preference. The lead roll should be carefully placed around the pipe so that it fits firmly against the hub to avoid leakage of the lead. A break in the pouring to stop a leak usually leaves a seam in the joint where the lead has cooled so that it is never as good a joint as one continuously poured. The bottom of the joint should be caulked first, working up each side of the pipe, leaving the top for the last. The joint should be driven up until the caulking tool rebounds slightly from the lead.

A cement joint is much cheaper than lead and more rigid. A pipe laid with cement joints will not come and go as much as one using lead joints under excessive expansion and contraction, vibration or settling. Settling of the pipe will cause a fracture when cement joints are used, and for that reason they cannot be recommended for general use. A cement joint is made with neat Portland cement by driving a roll of dry jute tightly to the bottom of the bell, then filling evenly with cement to a point about half the depth of the bell and then adding another roll of jute driven against the cement until the moisture shows on the jute. The bell should then be filled evenly with cement to the face of the hub.

Leadite is a composition in the form of a black powder, the base of which is sulphur, and which is used in the same manner as lead with the exception that no caulking is required. Great care is necessary in handling it, as too high a temperature thickens it so that it cannot be run into the joint and the sulphur will ignite if allowed to get too hot. Leadite is 25 to 30 per cent cheaper than lead. A small leak in a leadite joint will soon be filled by rust, as part of the composition is iron.

Lead wool is used in the same manner as jute and is useful in water and where it would not be convenient to pour a joint. It is also useful in making repairs to leaking or blown out lead joints. The cost is about 25 per cent greater than joints made with pig lead.

Rust joints made of iron chips, sal ammoniac and water are seldom used now, although in former years they were used frequently for low pressure cast iron steam and hot water lines.

Wood stave pipe is constructed of staves, machined to a circle and held together with a flat, soft steel band wound spirally around the pipe, the finished pipe being coated with asphaltum and rolled in sawdust or wood shavings. The use of this pipe developed very rapidly on the Pacific coast where the cost of transportation of cast iron pipe made its use almost prohibitive and an abundance of suitable timber was close at hand. For many installations wood stave pipe will not answer the purpose as well as cast iron, although where the pressure is constant or the water is highly charged with acid, it should give satisfaction.

The term "wrought iron pipe" as generally used designates both wrought iron and steel pipe, while as a matter of fact there is a wide distinction between the two. Genuine wrought iron pipe is rarely furnished unless so specified and purchased on analysis. The advantage of genuine wrought iron pipe is chiefly in its greater resistance to corrosion, although it will be found to cut and thread more easily than steel pipe. Its cost is about 20 per cent more than steel. As in many instances the cost of the pipe is a comparatively small item in the total cost of conduit, wrought iron pipe would seem to be justified regardless of the first cost. One of the most severe usages to which pipe may be put is roundhouse service, either for overhead steam, water, or air line, or for heater pipes in pits, since the coal gases quickly attack the overhead lines and the moisture corrodes the pipes in the pits. Wrought iron pipes will easily last 50 per cent longer than steel under these conditions.

Steel pipe is stronger than wrought iron, and where the pipe is not subject to excessive corrosion, common merchantable steel pipe will answer for general service above ground, but wrought iron pipe is preferable for underground work. A cheap and effective method of protecting pipe laid underground is to coat it with asphaltum or pitch and wrap it with burlap. Where the water is used for drinking or other sanitary purposes, galvanized or tin-lined pipe should be used as certain waters are affected by contact with iron. Suction lines for pumps are subject to more or less vibration and the importance of keeping such lines tight necessitates the use of a threaded pipe, which should be wrought iron in preference to steel. Steel well casings are subject to rapid decay and the increased life of wrought iron pipe would justify its use for this purpose. Aside from suction lines and well casing the use of either steel or wrought iron pipe larger than three inches would not be justified for underground service.

In laying underground water pipes it is necessary to consider the soil conditions as affecting the life of the pipe as well as the quality of the pipe itself. It is well known that clay forms the best possible covering for underground pipe, and cinders the worst. When laying pipe through cinders, an effective protection can be secured at a small expense by flooring the ditch and covering the pipe with clay. Although it is not always possible to find favorable soil conditions, in many cases slight changes in the location of the pipe line may double the life of the pipe through securing a better soil. In preparing the trench, the bottom should be uniform so that the joints will not be cramped. Pipe laid along the right of way or near tracks should be as far from the tracks as possible on account of the effect of vibration from passing trains and the possibility of track changes throwing the pipe under the tracks. The trench should be deep enough to permit laying the pipe below the frost line.

All leaks in water mains may be classed under one of the following causes; settling of the pipe; expansion and contraction; deterioration through corrosion; electrolysis, and poor joints. In general, little trouble will be experienced from settling unless the pipe is laid in new-made fill or very soft ground. Whenever it is possible to avoid it, pipe should never be laid in a new fill until it has had time to settle thoroughly. Where pipe is laid through soft soil the ditch should be well floored or piling driven. Little trouble will be experienced with underground mains from expansion and contraction where cold water is used, but where hot and cold water are alternately pumped through the line, as is the case at some mechanical terminals, trouble from leaks due to expansion and contraction of the pipe is unavoidable. Leakage in mains laid under or near tracks may be reduced by burying the pipe to the maximum depth and placing as few joints as possible under the track. The trouble may sometimes be eliminated by bridging over the pipe with heavy timbers to support the ties.

Leakage from corrosion in a cast iron pipe is very remote and is hardly worth considering, except that caused by electrolysis. Electrolysis caused by the passage of stray current from power lines or electric railways along the underground pipe occurs only at the points where the current leaves the pipe. At such points corrosion of the iron from electrolysis will take place, which, theoretically, will amount to a loss of 20 lb. of iron per year for every ampere of electric current leaving the iron. Experiments have shown that this theoretical corrosion is at least equalled and sometimes exceeded. For a given current leaving the pipe there is practically no difference in the amount of iron destroyed between cast iron, wrought iron and steel. The electrical resistivity of cast iron is, however, about 10 times as great as that of wrought iron or steel, and the usual lead joint cast iron pipe also has a resistance 20 times greater than the screw coupling joints usual with wrought iron and steel pipes. For these reasons a given voltage drop will cause a much smaller current to flow on a cast iron pipe than on a wrought iron or steel pipe, thus making cast iron pipe practically much less subject to electrolysis than wrought iron or steel.

The principal cause of leaks is poor joints. Proper attention to joints will always pay, the only safe course when leaks develop being to stop them at once. Wherever possible, joints

should be tested to the maximum pressure before being covered.

Incrustations and deposits in water pipe seriously affect the carrying capacity of the pipe and by increasing the friction very materially increase the cost of pumping. The frictional loss in dirty water mains is far in excess of the actual reduction in area due to the roughness of the pipe. As a matter of fact, the interior coating of new pipe may affect the carrying capacity as much as 20 per cent due to the care and smoothness with which it is applied.

The question of water hammer caused by stopping the flow in a water pipe is of great practical importance, as the shocks frequently bursts the pipe. The simplest method of protecting pipes from water hammer is to use slow closing gates. The duration of closure should be proportional to the length of the pipe line. Air chambers of adequate size placed near the valves and gates eliminate almost entirely the hydraulic shock and do not allow the pressure wave to pass through them, but they must be very large and it is difficult to keep them supplied with air. Safety valves allow pressure waves with only such intensity as correspond to the elasticity of the springs of the safety valves to pass through them.

Committee: C. R. Knowles (I. C.), chairman; J. B. White (C. & N. W.), James Dupree (C. T. H. & S. E.), John Ewart (B. & M.), C. F. Warcup (G. T.), and M. G. Manning (C. G. W.).

Discussion

The figures relative to the cost of laying pipe aroused considerable discussion. James Dupree (C. T. H. & S. E. Ry.) expressed the opinion that the figures were too low, especially those in reference to leading joints. He said that he used two pounds of lead per inch diameter of pipe. Several members thought that there was practically no difference in the cost of excavating for pipe from four to twelve inches in diameter. In discussing cemented joints for steel pipe Mr. Dupree said that he always found them unsatisfactory. A. H. King (O. S. L.) reported the same experience. J. B. Sheldon (N. Y. N. H. & H.) said that he overcame the difficulty in maintaining tight joints in water pipes subject to water hammer by the substitution of flanged joints for leaded joints. J. S. Robinson (C. &. N. W.) said that he had found the gaskets wearing in the flanged joints thereby causing leaks. A. A. Wolf (C. M. & St. P.) said that he overcame this difficulty by using metal gaskets. R. Henderson (B. & O.) reported that he had laid three miles of pipe with flanged joints satisfactorily by placing a wood block under each joint. In discussing the water hammer several members reported satisfactory results following the installation of air chambers or slow closing valves, while others reported these practices ineffective. W. C. Frazier (S. P. L. A. & St. L.) described an installation of wood stave pipe lines ranging from four to eighteen inches in diameter at Las Vegas, Nev., with redwood staves one inch thick which proved unsatisfactory because of the difficulty in keeping the bands on. He stated that it requires three or four men working continuously to replace the bands and that galvanized iron bands were found but little better than common iron bands. J. F. Fisher (S. P.) reported trouble with root growths in wood pipe. A. H. King (O. S. L.) said that he had had difficulty with alfalfa and other roots entering at joints and that it was necessary to take the pipe apart to clean it. He never found any mossy growth inside. A. A. Wolf (C. M. & St. P.) on the other hand, said that he had had to remove pipe clogged by moss. In laying iron pipe under tracks he has placed the pipe in a larger conduit of concrete culvert pipe, thereby eliminating leaky joints.

CONCRETE POSTS AND POLES

Concrete Posts.—At the present time wooden posts are as cheap and in many instances cheaper in first cost than any substitute which has been brought forward, but because of their short life and liability to destruction by fire, there is a question whether any wooden post with the exception of one or two kinds of wood, is as cheap as a well designed and well manufactured concrete post. Many persons have studied concrete as a suitable substitute for wood in posts, and naturally some errors in design have been made, many posts have been poorly manufactured, and a good many failures have resulted. Also, as is usual in a new field, there have been some whose enthusiasm outran their judgment and extravagant claims which could not be backed up were made. The posts were found to be difficult to handle on account of their weight and were easily broken. Considerable difficulty was experienced in finding a satisfactory method of fastening the fence to the post, especially as many of the earlier designs were straight or had a very slight taper. Notwithstanding these drawbacks, concrete posts have established themselves permanently and as the supply of wooden posts continues to diminish, their use will rapidly increase.

Any fence post, to secure extended use, must fulfil the requirements of stability, durability, efficiency and economy. Experience has shown that the concrete post is as stable as the wooden one. The very quality, weight, which makes it difficult to handle during manufacture and while being distributed, is a marked advantage in securing stability after it has been set. Again, when used in low, wet places and in localities subject to overflow, the advantages of the concrete post are apparent.

Concrete posts have not been in use a sufficient length of time to enable accurate data to be secured as to their life, but judging by the performance of concrete under other circumstances it is felt that a life of 40 years may be safely predicted for a properly designed and manufactured post.

Experience shows that the concrete post is as efficient as the wooden one. It has the further advantage of not being subject to destruction by fire. As to economy, the weight of evidence is in favor of the concrete post. Wooden posts cost from $0.10 to $0.30, depending on the kind of wood used and the locality. The average for those most commonly in use is conservatively $0.16 to $0.17 and their average life from 12 to 15 years. Concrete posts cost from $0.16 to $0.20, with the average for the heavier posts about $0.18. It therefore requires no complicated calculation to determine the relative economy of wooden and concrete posts. They have the further advantage that they can be made near the point where they are to be used.

Many ideas as to the best designs of concrete posts have been advanced. The shapes vary from square and rectangular to round or triangular. There are also T-shaped posts and semi-circular, or rather semi-elliptical and rectangular sections with one end semi-circular. In size they vary from 3 in. to 6 in. at the top and from 4 in. to 8 in. at the bottom. In some instances the posts are spread at the bottom. Many of the early posts were made straight or with a very light batter. The committee believes that in general those sections having the smaller perimeter for any given section will prove more satisfactory.

Experience has shown that straight posts or those with a very slight batter are apt to heave with the frost. In these designs it is also difficult to prevent the fence slipping down on the posts. For these reasons posts are now generally made with a decided batter, and the committee believes the taper should be uniform from top to bottom. It has been found that the lighter posts could not always be depended on to resist the strain to which they are subjected, especially in those sections of the country where stock is plentiful, and the recent tendency seems to be toward the use of a heavier post. The advantages of the lighter post are the small decrease in cost due to less material used and the lighter weight of the post, which is some advantage in handling and shipping. The latter advantage is offset somewhat by the fact that greater care must be used to prevent breakage. The committee recommends that the minimum diameter at the top should be 4 in. and at the bottom 5½ in.

The methods of reinforcing are nearly as numerous as the shapes of the sections. They can be divided into two general

classes those reinforced with core reinforcing and those in which the reinforcing is placed near the circumference. Reinforcing material consists of plain round or square rods, hoop steel, steel wire, sheet steel cut and pressed into required shapes, twisted or corrugated bars, and in some instances a combination of two of the above. In some instances the rods are wound with wire and in others crimped wires are used. The committee believes that reinforcement should be placed near the circumference of the post where the greatest stresses are likely to occur and where it is reasonable to expect the tendency to crack is the greatest. The critical section of the post is near the surface of the ground and frequently extra reinforcing is placed at this point. The committee does not believe that this is called for, but it may be found desirable under special conditions where posts are subjected to unusually hard service.

In general, concrete for posts is made of crushed rock or screened gravel, though bank gravel is frequently used. The latter material usually is not as clean as the screened gravel and under these conditions as good results cannot be expected. Better proportioning of the materials can also be obtained with the stone or screened gravel and sand. The concrete should be as dense as possible. This adds somewhat to the strength of the post, since by decreasing the amount of absorption it decreases the chances of corrosion of the reinforcing and to a considerable extent prevents deterioration of the posts due to the action of frost. For this reason posts should be made of a comparatively rich mixture. The cost of the cement is a small proportion of the total cost of the post and the cost of the additional cement which makes the difference between a lean and a rich mixture is negligible.

On account of the comparatively small section of a fence post and the placing of the reinforcement, it is undesirable that the coarser aggregate should be of a large size. Experience has shown that the gravel or crushed rock should not exceed ½ in., nor be less than ¼ in. in size. The committee recommends a mixture consisting of one part of cement, two parts of clean, sharp sand and four parts of broken stone or screened gravel. When bank gravel is used, a mixture of one part cement and four parts of gravel is recommended.

While reinforcement should be placed near the outer surface it is necessary that it be protected by the concrete. On this account it is recommended that it be placed ½ in. below the surface. It is also recommended that the reinforcing material be long enough to permit turning it down at the end. Recent experiments develop the fact that slightly rusted reinforcement gives a decidedly stronger bond with the concrete than does the clean, bright metal, or metal with the mill scale on.

Wherever possible, concrete for posts should be mixed in a batch mixer. Machine mixed concrete is recognized as superior to hand mixed, as the cement is more thoroughly incorporated with the sand and stone and the stone itself is more uniformly distributed. All materials should be measured. The amount of water added should produce a quaking mixture. This consistency will be wet enough to cause the concrete to settle around the reinforcing and produce a smooth surface. If it is made wetter there is danger of part of the cement being washed off the sand and stone and rising to the top. This results in an inferior product which will give a larger percentage of breakage and a shorter life.

Posts should never be made during freezing weather. On account of the small volume of a post it is more easily affected by low temperatures than concrete in large volumes. For the same reason the concrete in posts is apt to dry out rapidly in hot or very dry weather. It is therefore essential that they be kept moist for the first week or ten days and during this time they should not be exposed to the sun. Posts should be retained in the mold for three days after it is cast and it is better to allow four days. As soon as the concrete is set, water should be poured over it and the post kept thoroughly wet until removed from the molds. After removal it should be stored under cover and in such manner that it can be kept moist for the period specified. Great care must be exercised in handling the posts at this period as they are very easily broken. They should be stored upright with the larger end down. Concrete gains rapidly in strength and the bond between the concrete and reinforcing increases rapidly up to 30 days and only slightly less rapidly during the next 30. At the end of 90 days this strength has developed so that the post can safely be used if care is taken in handling. No post should be used earlier than 90 days after it is made. Difficulty is frequently experienced in casting posts on account of the concrete sticking to the molds. For this reason it is customary to oil the surface of the mold or to brush it with a solution of soap. Either oil or soap should be used sparingly. The molds should be scrubbed and cleaned with a stiff broom frequently. In general, it is desirable to have a plant equipment sufficient for a daily output of at least 400 posts. This will require molds for 1,200 to 1,600 posts, depending on whether they are left in the molds three or four days.

The handling and shipping of concrete posts are fully as important as the actual manufacture. Wooden posts can be thrown about, piled in cars or on the ground and handled very roughly without impairing their value. This cannot be done with concrete posts. When shipped, the posts should be carefully packed in straw or sawdust. In unloading, they should not be thrown on the ground, particularly if it is hard or uneven.

Concrete posts are set in the same manner as wooden ones and under normal conditions a man can set as many concrete as wooden posts. Many methods of fastening the fence to the posts have been devised. Small holes were made through the posts at stated intervals and nails or wire run through them to be bent around the fence wires. Wooden blocks were inserted and anchored in the posts during manufacture. In some instances staples were placed in the posts while the concrete was green. None of these methods proved satisfactory. Holes or staples could not be located where the fence wire would come, as it is seldom possible to set the posts at exactly the same depth. Irregularities in the ground also caused difficulties with this type of fastening. Again, this type of fastening sooner or later rusts out and cannot be replaced. Holes and wooden inserts weaken the posts and are in every way unsatisfactory. The most satisfactory method of attaching the fence is to use tie wires around the posts, attaching them to the fence wire by means of the "Western Union twist." Care must be exercised to have the tie wires tight and the fence wire drawn up snug to the fence post, otherwise the fence will slip down on the post and stock running against it or trying to get through will raise or press the fence down. This method of fastening the fence to the post will be most satisfactory where the post is made with a taper.

Concrete Poles.—In considering concrete as a substitute for wooden poles, a quite different situation is found. While the concrete posts can be easily manufactured and handled substantially the same as the wooden posts, the concrete pole is expensive, the handling of the forms is troublesome, and the erection of the pole requires radically different methods from the wooden one on account of its great weight. In spite of these drawbacks there are a number of points in favor of these poles. A number of telegraph lines have been put in service with concrete poles, notably on the Pennsylvania, where it is understood that they proved very satisfactory during the unprecedented winter of 1913-14. The extra expenditure for a concrete pole may be justified in order to safeguard heavy and important lines, but the committee does not believe it can be justified for lighter and less important lines.

Committee: George E. Boyd (D. L. & W.), chairman; A. S. Markley (C. & E. I.), C. W. Wright (L. I.), F. J. Conn (C. N. O. & T. P.), and W. E. Elder (C. B. & Q.).

Discussion

A. S. Markley (C. & E. I.) thought it unnecessary to hold posts 90 days before using them. He also thought the prices

given in the report were too low. He has found reinforcing separators detrimental to the strength of the posts.

CLOSING BUSINESS

At the closing business session the following officers were elected for the coming year: President, L. D. Hadwen, engineer of masonry construction, Chicago, Milwaukee & St. Paul, Chicago; first vice-president, G. Aldrich, bridge supervisor, New York, New Haven & Hartford, Boston, Mass.; second vice-president, G. W. Rear, general inspector, Southern Pacific, San Francisco, Cal.; third vice-president, C. E. Smith, assistant chief engineer, Missouri Pacific, St. Louis, Mo.; fourth vice-president, E. B. Ashby, chief engineer, Lehigh Valley, New York; secretary, C. A. Lichty, general inspector, Chicago & North Western, Chicago; treasurer, F. E. Weise, chief clerk, engineering department, Chicago, Milwaukee & St. Paul, Chicago.

Detroit was selected as the place for next year's convention. The subjects selected for next year's committee work include: (1) Locomotive Cranes in Construction Work and Handling Material; (2) Conditions Under Which Pile and Timber Bridges Should Be Repaired, Reinforced, Renewed or Replaced; (3) Railway Water Tanks; (4) Coaling Plants for Small Stations; (5) Compilation, Analysis and Value of Cost Data; (6) Efficient Methods for Handling Work. The following committees for this year also were continued: (2) Warning for Overhead and Side Obstructions; (4) Reinforced Concrete Bridge Work; (5) Station Buildings for Passenger Service Only, and (9) Concrete Culvert Pipe and Concrete Piles.

On Tuesday evening, 234 members and guests attended a banquet in the Alexandria Hotel. G. W. Rear (S. P.) was toastmaster, and the speakers included W. H. Whalen, division superintendent of the Southern Pacific at Los Angeles; E. A. Baley, who described the Los Angeles aqueduct; H. B. Titcomb, engineer maintenance of way of the Southern Pacific; President Penwell and others. Late Wednesday afternoon there was a trip to Ocean Park, where the party remained for the evening. On Thursday evening there was a trip up Mount Lowe. There were also various other rides arranged for the ladies.

SUPPLY ASSOCIATION

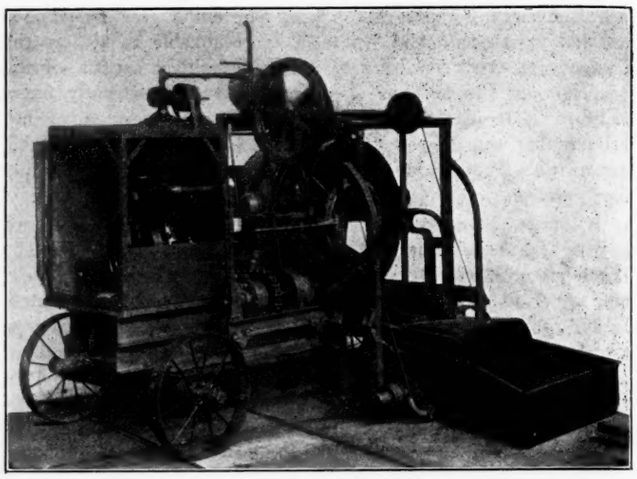
On account of the excessive cost of sending exhibits and representatives to Los Angeles, very few of the supply firms that hold membership in the Bridge and Building Supply Men's Association were represented at the convention. It was agreed before the convention that no meeting would be held at the convention and that the existing officers would continue their duties for another year. These officers are: President, J. A. Meaden, Paul Dickinson, Inc.; vice-president, D. A. Bonitz, National Roofing Company; treasurer, H. A. Neally, Joseph Dixon Crucible Company; secretary, L. D. Mitchell, Detroit Graphite Company; members of the executive committee, C. E. Ward, U. S. Wind Engine & Pump Company, and W. A. Hemenway, Asphalt Ready Roofing Company.

THE SMITH-CHICAGO CONCRETE MIXER

An improved type of the Chicago mixer formerly sold by the Chicago Concrete Machinery Company, Chicago, will be handled in the future under the name of the Smith-Chicago mixer by the T. L. Smith Company, Milwaukee, Wis. In distinction to the other Smith mixers, the new type has a non-tilting discharge.

The cylindrical drum has a centrally located ring encircling it, which combines the main driving gear and the main roller track in one substantial casting, the rollers being protected by the overhanging drum heads. No movable parts are located in the drum where they can come in contact with the mix. The mixing action is secured by large scoop blades with deep converging sides which pour the batch to the center of the drum. The action of these blades combined with the action of the drum itself, produces a movement in the mass which distributes the loads evenly and produces an efficient mixture without splashing.

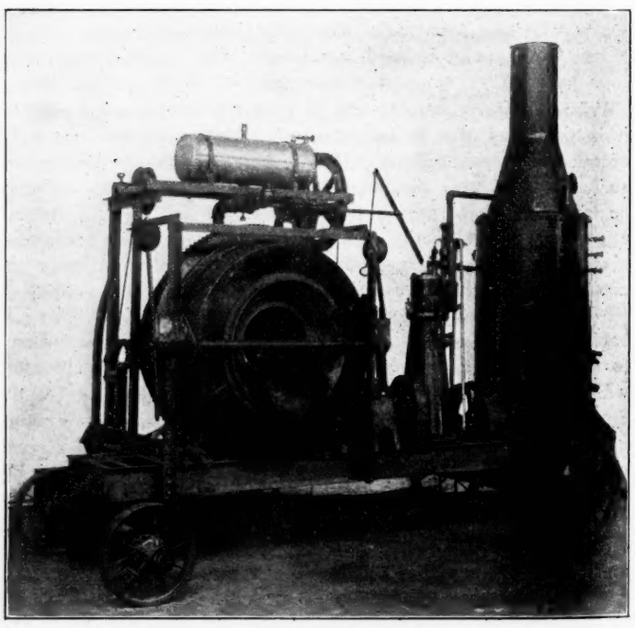
The external discharge chute is pivoted above the discharge opening, projecting two-thirds of the way through the drum. The length and steep angle of this chute are made possible by the concave face of the drum. This discharge chute can be used to measure small quantities of concrete with accuracy or to discharge the entire batch rapidly. When the discharge chute is not in the discharging position, it



The Smith-Chicago Mixer with Gasolene Engine, Power Charger and Enclosed Water Tank

swings out and up, draining back into the drum. In this position it does not interfere with the wheelbarrows or hoisting buckets. On self-loading machines this spout can be operated either from the feed or discharge side of the machine.

The new type of mixer can be equipped with a standard feed chute, a vertical acting power charger, or a gated batch



The Smith-Chicago Mixer with Steam Engine, Boiler, Power Charger and Enclosed Water Tank. The Chute is Shown in Discharging Position

hopper. The power charger consists of a skip carried by four rollers traveling on curved guides. The skip is hoisted by cables, the wide nose projecting well into the drum in the discharging position. These chargers are equipped with a device automatically to disengage the clutch when the skip has reached its highest position, forming an effectual safeguard against accidents.

General News Department

The new union station of the Illinois Central, the Yazoo & Mississippi Valley, the Chicago, Rock Island & Pacific, and the St. Louis & San Francisco, at Memphis, Tenn., was opened on October 21.

The freight house of the Northern Pacific at Duluth, Minn., sustained considerable damage from fire on the night of October 11. The loaded cars in the shed were all saved. The damage is estimated at $20,000.

November 9 has been set as the date for the beginning of hearings at Chicago in the arbitration proceedings on the demands of the enginemen and firemen of the western railways, although the board of arbitration is not yet complete. The two arbitrators representing the employees and the two representing the railroads have been selected, but they have not yet agreed upon the two neutral members.

The Interstate Commerce Commission has postponed to March 31, 1915, the date on which carriers must have complied with its order under the transportation-of-explosives act, requiring gas cylinders to be supplied with certain safety devices. Owners of such cylinders placed orders in Europe for the required devices, but now have informed the commission that their orders cannot be filled within the time limit fixed.

The voters of Roseburg, Ore., last week voted to authorize a $500,000 bond issue to assist in the construction of a proposed railroad from Roseburg to Coos Bay, Ore., in order to secure rail communication with the Pacific ocean, which has been projected for nearly 40 years. The town elected a railroad commission of 10 members to represent the people's interest in the matter. The money is not to be expended until the people are assured by a sufficient bond that a standard gage road will be constructed between Roseburg and Coos Bay to be operated for a term of years under conditions satisfactory to the members of the commission. In that case the $500,000 will be appropriated to assist in the work. The proposed line has been surveyed and a part of the grading has been completed under a former project.

J. W. Everman, general manager of the St. Louis Southwestern, who took that position on July 1, after 33 years' service with the Texas & Pacific, was presented with a silver service of 186 pieces, costing $1,200, by a committee representing the 10,000 employees of the Texas & Pacific, at a luncheon at Dallas on October 13. The committee was composed of 40 of the Texas & Pacific employees, and the presentation was made by George Thompson, general attorney for the Texas & Pacific. In addition to the Texas & Pacific men the principal officers of the St. Louis Southwestern were present at the luncheon, including President F. H. Britton, Vice-president H. E. Farrell, General Solicitor S. H. West, Chief Engineer C. D. Purdon, Purchasing Agent Ernest Baxter, General Attorney E. B. Perkins, Superintendent F. J. Hawn and W. C. Connor, president of the Dallas Terminal Railway & Union Depot Company.

The Baltimore & Ohio, in order to "see itself as others see it," has ordered W. E. Lowes, assistant general passenger agent, to make a tour of its lines on an inspector's gasolene tricycle to collect first-hand information. Accompanied by a photographer and a supervisor of track, Mr. Lowes has already covered a portion of the main line and some of the branches of the eastern divisions. In the Shenandoah Valley, along the south branch of the Potomac river and in eastern Ohio, a number of exquisite photographs of historical interest and scenic beauty have been taken and will be used in advertising. Up to this time Mr. Lowes has traveled from fifty to sixty miles a day, stopping to talk over business conditions with agents at small stations, as well as with farmers in the fields and workmen in industries along the route. From farmers he obtains information concerning the fertility of soil and its adaptability to particular phases of farming, learns the yield per acre in the community and the amount of fertilizer, farming machinery and articles shipped in, and gives and receives information about markets.

Disastrous Collision in France

A press despatch from Pas-de Calais, France, October 19, says that between forty and fifty passengers were killed and eighty injured in a butting collision on the 17th at Marquise, between Calais and Boulogne. The trains carried soldiers and refugees. The cause of the collision is given as a broken signal wire, which allowed a signal to change from "stop" to "proceed."

Repeal the "Full-Crew" Laws!

The following appeal, issued by the Pennsylvania Railroad, has been posted in all the stations along the company's lines, and also on trainmen's bulletins:

"It is in the interest of the public—whose chief concern is good service and safety—that the extra crew law now on the statute books of Pennsylvania, New Jersey and New York be repealed. This law causes a waste of $1,100,000 annually in the employment of unnecessary men on the Pennsylvania system alone. No one is more concerned than the Pennsylvania Railroad Company in securing maximum safety on its lines. Every train on this railroad has a full crew, and this extra expenditure adds nothing to safety or public convenience. The same money had much better be spent to remove grade crossings, improve tracks, signals and bridges and buy steel cars.

"This extra crew law, which compels unnecessary expenditures, is one of the factors which menaces the ability of this company to pay present rates of wages to that great body of employees whose activities are needed. The Public Service Commission should see to it that all trains are properly manned. Such action would amply protect employees and the public. We appeal to the people in their own interest, we appeal to our employees in their best interest, to ask their representatives in the next Pennsylvania, New Jersey and New York legislatures to repeal the extra crew law."

Trespassing Reduced*

In New York state we have a definite law prohibiting trespassing on railroads and making it a punishable offense. We have within the past year employed a special man to personally visit the judges of all courts having jurisdiction in trespassing cases along the entire road, to obtain their co-operation in the enforcement of the law. Not only in New York but all other states through which our lines run the editors of newspapers were personally visited and their aid procured in giving wide publicity to our campaign. We posted at frequent intervals warning notices in various languages along the entire right-of-way, warning the public that arrest or injury would be the probable penalty for track walking. We prepared graphic maps indicating the number and location of trespass, death and injury cases, which we displayed in prominent store windows in important cities along our lines. We distributed pamphlets and circulars to the superintendents of schools and heads of industrial plants, enlightening them and obtaining their co-operation. And, because we did all of these things in a persistent manner, thereby educating and warning the public against the dangers of trespassing, there were during the year ending June 30, 1914, on the four principal roads of the New York Central Lines 109 fewer trespassers killed and 83 fewer trespassers injured than during the previous twelve months.

Let us, then, make education our watchword as well as safety our creed. Let us light the torch of prudence and hold it aloft that its rays may penetrate the remotest corners of the land, eradicating the darkness of ignorance which cloaks the chance

*Extract from an address by Marcus A. Dow, general safety agent of the New York Central, before the annual convention of the National Council for Industrial Safety, at Chicago, October 15.

REVENUES AND EXPENSES OF RAILWAYS

Month of July, 1914

Name of road.	Average mileage operated during period.	Operating revenues: Freight.	Passenger.	Total. inc. misc.	Operating expenses: Maintenance: Way and structures.	Of equipment.	Traffic.	Transportation.	Miscellaneous.	General.	Total.	Net operating revenue (or deficit).	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Ann Arbor	292	$119,810	$56,987	$191,112	$20,442	$24,805	$5,140	$72,268	$549	$6,642	$129,845	$61,267	$13,880	$47,387	$3,806
Chicago, Indianapolis & Louisville	618	394,518	153,292	596,067	72,317	108,041	18,569	211,720	226	19,326	429,773	166,294	26,645	139,649	942

Month of August, 1914

Alabama & Vicksburg	143	$79,164	$44,571	$136,255	$22,398	$33,413	$3,722	$48,003	$3,292	$5,255	$116,084	$20,171	$7,240	$12,931	—$10,719
Alabama Great Southern	309	311,483	116,028	465,394	50,825	120,417	13,915	155,557	4,150	8,607	353,472	111,923	15,493	96,399	—4,659
Atchison, Topeka & Santa Fe	8,470	5,736,359	2,071,599	8,421,750	1,185,026	1,428,424	156,487	2,269,571	.....	150,813	5,185,405	3,236,345	397,420	2,837,930	372,968
Atlanta & West Point	93	48,020	46,077	107,251	19,072	27,373	5,646	33,554	2,389	4,292	92,326	14,925	7,125	7,783	—7,680
Atlanta, Birmingham & Atlantic	646	156,365	67,409	243,735	35,964	44,591	13,494	101,565	.....	10,275	205,889	37,846	14,337	23,488	1,605
Atlantic & St. Lawrence	167	82,760	37,418	130,308	20,027	15,421	3,812	49,037	.....	2,570	90,867	39,441	10,800	28,641	10,947
Atlantic City	170	78,521	324,431	417,429	28,253	30,381	5,984	155,842	50	1,362	221,871	195,557	13,500	182,039	—45,347
Atlantic Coast Line	4,664	1,349,430	675,396	2,213,766	423,552	505,207	53,106	917,644	6,510	75,890	1,972,238	241,528	138,000	103,522	—73,999
Baltimore & Ohio—System	4,516	6,507,131	1,604,011	8,700,376	873,944	1,575,243	166,274	3,108,681	36,348	172,566	5,933,057	2,767,319	257,655	2,509,275	—231,459
Baltimore & Ohio Chicago Terminal	79	.....	786	147,371	18,941	21,199	857	56,922	4,578	4,860	107,357	40,014	19,021	20,992	—2,506
Bangor & Aroostook	631	151,329	68,155	234,267	51,539	48,684	2,885	79,644	1,938	9,116	193,805	40,462	8,750	31,708	—7,617
Belt Ry. Co. of Chicago	24	.....	.....	291,236	22,922	24,643	776	90,403	.....	6,096	144,841	146,396	12,113	134,282	48,388
Bessemer & Lake Erie	204	1,077,912	56,256	1,150,608	60,581	159,752	9,357	204,567	2,492	10,439	446,999	703,609	18,000	685,608	173,395
Bingham & Garfield	27	102,598	4,954	108,431	9,031	15,517	849	17,558	125	1,350	44,430	64,001	1,509	62,492	—16,237
Birmingham Southern	43	44,411	1,237	84,038	18,607	14,031	435	30,025	.....	3,370	66,469	17,570	1,719	15,851	—23,565
Boston & Maine	2,252	2,336,137	1,698,366	4,384,001	721,307	696,748	30,713	1,727,671	21,819	93,065	3,291,323	1,092,678	171,070	921,608	—329,181
Buffalo & Susquehanna R. R. Corporation	253	132,596	8,442	143,936	27,342	37,743	1,167	39,859	.....	5,300	111,411	32,525	2,600	29,925	.....
Buffalo & Susquehanna Ry	91	15,642	10,610	29,167	7,132	10,531	539	12,710	57	2,933	33,903	—4,736	1,600	—6,336	—1,562
Buffalo, Rochester & Pittsburgh	586	880,107	127,129	1,040,683	164,998	254,501	11,344	287,363	1,370	17,181	736,756	303,926	20,000	283,919	—60,346
Canadian Pacific Lines in Maine	233	42,209	20,558	68,886	22,785	17,028	6,691	32,897	.....	3,853	83,255	—14,369	12,000	—26,369	—495
Carolina, Clinchfield & Ohio	248	155,574	21,215	182,103	18,678	21,876	6,754	34,789	.....	8,285	88,732	93,370	14,250	79,085	—58,055
Carolina, Clinchfield & Ohio of S. C	18	8,817	2,048	11,168	1,141	104	1,917	2,104	.....	704	5,970	5,198	750	4,448	—3,798
Central of Georgia	1,924	597,554	335,972	1,031,504	153,356	215,465	34,164	372,177	1,509	33,601	810,228	221,276	52,360	168,939	79,700
Central of New Jersey	678	1,792,986	740,932	2,683,788	233,338	431,672	29,897	879,237	16,158	48,027	1,638,247	1,045,540	112,376	933,165	—131,902
Central New England	304	254,055	47,605	314,877	85,874	35,682	983	101,731	.....	4,165	248,405	86,471	11,000	75,471	—54,714
Central Vermont	411	224,624	105,926	361,957	76,118	54,691	8,300	145,302	3,053	5,874	293,338	68,620	15,760	52,859	7,722
Charleston & Western Carolina	341	99,781	38,628	146,022	31,982	30,399	3,743	57,045	.....	4,126	127,295	18,727	5,000	13,727	—11,217
Chesapeake & Ohio Lines	2,367	2,708,839	617,389	3,519,057	394,042	742,148	55,613	1,077,424	21,430	71,901	2,362,557	1,156,500	109,922	1,046,578	—33,284
Chicago & Eastern Illinois	1,282	987,402	295,209	1,385,512	152,738	280,973	21,481	467,712	8,181	36,436	967,522	417,990	56,900	361,029	153,538
Chicago & Erie	270	414,154	61,218	521,247	87,841	113,223	19,366	233,338	2,065	15,228	471,061	50,186	12,895	37,291	78,288
Chicago & North Western	8,108	4,748,395	2,254,794	7,768,873	1,389,868	1,173,119	112,169	2,475,717	56,552	139,021	5,346,446	2,422,428	375,000	2,047,186	—32,745
Chicago, Burlington & Quincy	9,264	5,871,384	2,163,915	8,742,382	1,020,824	1,389,088	152,648	2,425,581	67,930	171,815	5,227,887	3,514,495	332,528	3,181,967	—51,953
Chicago, Detroit & Can. Gd. Trunk Jctn.	60	47,107	19,562	79,638	12,935	9,412	1,802	43,244	.....	1,199	68,591	11,047	2,870	8,177	—15,218
Chicago Great Western	1,427	884,095	319,492	1,309,309	186,989	194,536	57,361	407,470	6,750	35,064	886,573	422,736	48,668	373,077	—20,965
Chicago, Indiana & Southern	359	304,748	31,617	349,680	53,498	83,491	5,902	117,082	1,519	10,131	271,622	78,057	18,700	59,350	35,276
Chicago Junction	12	.....	.....	163,649	21,887	19,098	992	82,663	.....	4,449	129,090	34,559	2,104	32,440	—27,386
Chicago, Milwaukee & St. Paul	9,987	5,456,401	1,898,329	8,189,201	1,155,705	1,150,657	160,676	3,080,780	68,980	136,696	5,592,937	2,596,265	438,577	2,149,240	247,387
Chicago, Peoria & St. Louis	255	119,603	32,468	160,126	26,100	26,495	5,537	57,831	.....	5,216	121,180	38,946	5,700	33,246	33,721
Chicago, Rock Island & Gulf	477	174,845	55,954	247,747	33,345	37,517	9,388	96,006	1,576	8,391	186,223	61,524	8,815	52,663	—12,063
Chicago, Rock Island & Pacific	7,852	4,187,117	1,804,472	6,420,284	911,708	1,063,347	143,833	2,342,342	45,089	132,921	4,632,558	1,787,726	231,660	1,555,620	203,484
Chicago, St. Paul, Minneapolis & Omaha	1,753	1,009,930	547,423	1,678,617	250,620	206,930	28,393	543,313	16,307	34,004	1,079,567	599,050	91,799	507,166	212,744
Chicago, Terre Haute & Southeastern	375	172,907	19,749	198,631	31,408	35,479	2,911	54,299	846	10,155	135,099	63,532	11,500	52,032	19,993
Cincinnati, Hamilton & Dayton	1,015	721,371	160,391	977,456	136,380	159,837	20,437	399,379	.....	18,960	734,993	242,463	40,042	202,307	28,437
Cincinnati, New Orleans & Texas Pacific	337	629,529	157,091	828,788	89,374	234,801	24,410	249,407	1,042	21,114	620,149	208,639	31,000	177,639	—55,615
Cincinnati Northern	246	118,684	31,777	157,402	22,469	25,983	2,509	48,295	.....	3,459	102,715	54,687	6,000	48,687	45,447
Cleveland, Cincinnati, Chic. & St. Louis	2,361	2,190,428	893,579	3,367,001	426,246	642,996	70,993	1,197,744	27,491	59,162	2,420,838	946,163	130,000	815,925	282,945
Colorado Midland	338	144,561	39,522	201,686	34,955	37,986	8,329	74,193	3,057	5,476	163,997	37,689	7,060	30,630	23,739
Colorado & Southern	1,127	444,477	189,579	680,028	107,363	151,589	11,149	207,711	5,471	18,632	501,916	178,112	35,625	142,487	—107,695
Cumberland Valley	164	200,230	67,523	282,482	51,666	32,078	3,794	93,621	787	6,925	188,871	93,611	5,910	87,701	5,801
Delaware, Lackawanna & Western	960	2,499,853	856,993	3,715,617	516,241	618,678	71,697	1,112,060	35,400	73,542	2,405,832	1,309,785	185,000	1,124,765	—128,802
Denver & Rio Grande	2,562	1,455,454	491,880	2,089,857	397,643	384,140	43,610	587,756	36,335	50,083	1,499,125	590,733	90,000	500,709	—82,971
Denver & Salt Lake	255	109,226	57,232	177,057	17,276	29,397	3,168	49,852	.....	5,541	104,787	72,269	4,500	67,769	—12,165
Detroit & Mackinac	400	56,132	37,317	102,057	12,827	15,635	1,935	33,804	439	2,598	67,238	34,819	9,108	25,711	—14,530
Detroit & Toledo Shore Line	79	114,769	.....	115,158	21,138	8,580	1,534	29,997	.....	2,417	63,666	51,493	5,900	45,593	—13,016
Detroit, Grand Haven & Milwaukee	191	138,000	64,000	230,413	36,710	33,664	7,229	101,239	1,189	4,878	184,909	45,504	3,360	42,144	7,966
Detroit, Toledo & Ironton	441	147,598	21,411	177,878	26,610	17,168	3,436	81,883	.....	6,217	135,314	42,564	6,000	36,564	87,729
Duluth & Iron Range	292	643,444	19,669	685,698	96,247	71,552	1,002	128,556	2,666	8,679	308,702	376,996	36,605	340,391	—393,230
Duluth, Missabe & Northern	364	781,935	32,355	835,661	79,296	79,781	2,410	129,800	3,846	9,756	304,889	530,772	41,906	488,865	—355,397
Duluth, South Shore & Atlantic	628	166,451	104,369	301,087	62,034	40,206	8,548	97,590	4,493	11,150	224,021	77,066	19,000	58,052	—24,384
Duluth, Winnipeg & Pacific	181	79,638	19,715	101,579	31,717	23,041	3,139	40,953	681	7,472	107,004	—5,425	5,079	—10,504	—43,428
El Paso & Southwestern Co	1,029	523,673	113,127	704,910	84,893	98,273	18,176	185,769	6,193	22,162	415,466	289,444	38,211	251,158	59,155
Elgin, Joliet & Eastern	777	784,187	4	831,572	78,106	142,580	5,204	222,192	.....	17,442	465,411	366,161	32,833	333,328	—33,074
Erie	1,988	3,582,510	975,643	4,967,519	558,366	929,992	94,539	1,664,860	36,350	96,980	3,365,944	1,601,575	138,547	1,462,836	70,243
Florence & Cripple Creek	87	83,128	29,096	113,940	14,584	9,739	1,804	32,054	.....	4,792	62,973	50,967	5,677	45,291	—24,442
Florida East Coast	696	150,132	111,801	299,293	57,284	47,318	5,696	127,335	.....	9,636	239,279	60,015	20,000	40,015	73,926
Fort Worth & Denver City	454	256,995	158,029	440,051	42,595	58,636	8,150	161,618	3,923	13,983	288,905	151,145	12,920	138,226	27,055

REVENUES AND EXPENSES OF RAILWAYS

MONTH OF AUGUST, 1914—CONTINUED

Name of road.	Average mileage operated during period.	Operating revenues			Operating expenses							Net operating revenue (or deficit).	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total. inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	Miscellaneous.	General.	Total.				
Galveston, Harrisburg & San Antonio	1,338	$695,723	$269,751	$1,049,329	$144,917	$191,817	$28,113	$416,040	$9,091	$33,448	$823,253	$226,076	$39,425	$186,553	—$99,744
Georgia	307	144,943	88,760	251,226	32,335	53,115	12,594	120,185	.....	7,250	225,479	25,747	3,789	21,958	6,089
Georgia, Southern & Florida	395	99,581	65,936	188,182	26,498	46,711	7,331	78,012	.....	9,239	167,791	20,391	10,943	9,388	5,893
Grand Rapids & Indiana	575	254,671	258,083	560,140	58,320	67,322	9,102	195,829	3,974	13,605	348,152	211,988	24,221	187,767	45,497
Grand Trunk Western	347	444,000	197,000	681,770	93,729	120,144	20,394	239,712	9,083	13,823	496,883	184,887	35,920	148,967	99,130
Great Northern	8,038	4,750,157	1,490,599	6,916,656	720,508	639,309	100,710	1,670,212	83,570	117,685	3,324,522	3,592,133	369,015	3,223,000	688,214
Gulf & Ship Island	308	109,381	32,500	150,765	19,301	29,481	2,332	35,531	195	7,304	94,145	56,621	7,395	49,226	—18,530
Gulf, Colorado & Santa Fe	1,937	992,617	322,610	1,383,388	162,680	187,706	29,607	454,873	.....	35,559	870,424	512,963	51,055	461,908	198,211
Hocking Valley	353	570,793	89,165	711,035	92,924	115,887	8,135	194,212	.....	12,469	423,627	287,409	38,800	248,609	—39,442
Houston & Texas Central	857	369,258	167,952	577,713	93,083	81,038	15,807	232,040	1,814	16,017	439,627	138,086	24,043	113,981	—10
Houston, East & West Texas	191	78,275	37,422	121,053	23,249	13,621	2,029	45,901	.....	2,861	87,626	33,428	4,249	29,146	3,735
Illinois Central	4,769	4,097,901	1,286,002	5,845,351	839,672	1,294,968	97,774	1,941,588	29,951	119,011	4,305,198	1,540,153	275,000	1,260,264	268,459
Indiana Harbor Belt	105	.....	.....	281,269	41,771	28,216	2,355	108,159	.....	7,330	187,831	93,438	7,785	85,649	16,262
International & Great Northern	1,160	477,722	196,381	727,346	147,183	117,538	24,384	327,733	2,938	26,002	645,778	81,569	25,000	56,552	—168,211
Kanawha & Michigan	177	284,602	34,313	325,488	40,213	70,510	2,455	85,715	8	6,936	205,838	119,651	11,889	107,761	5,994
Kansas City Southern	827	651,047	152,539	885,643	105,780	105,016	26,315	289,165	.....	42,705	567,602	318,041	49,082	268,706	—67,181
Lake Erie & Western	906	448,564	93,775	566,604	68,766	84,981	11,493	190,004	.....	11,272	366,517	200,087	24,500	175,587	93,448
Lake Shore & Michigan Southern	1,852	2,905,408	1,307,316	4,800,087	515,733	840,159	75,523	1,569,929	56,131	91,704	3,149,179	1,650,909	196,500	1,454,099	25,257
Lehigh & Hudson River	97	143,145	12,084	157,878	26,583	19,203	1,356	51,000	.....	3,368	101,509	56,369	4,150	52,219	24,933
Lehigh & New England	296	214,073	1,605	225,263	30,101	30,720	1,953	53,580	.....	6,139	122,493	102,770	5,670	97,100	43,018
Lehigh Valley	1,444	3,050,623	503,571	3,770,347	395,739	728,898	74,698	1,205,054	15,371	66,666	2,486,425	1,283,922	140,000	1,142,913	—36,838
Long Island	398	313,599	1,015,194	1,505,277	123,880	123,731	9,794	499,336	6,043	27,056	789,840	715,437	65,362	649,516	90,880
Louisiana & Arkansas	279	148,721	23,774	176,965	30,612	24,262	2,595	41,778	.....	4,473	103,719	73,246	6,450	66,796	10,732
Louisiana Ry. & Navigation	351	137,633	26,415	174,491	35,961	15,471	5,217	62,849	.....	4,923	124,421	50,070	8,500	41,570	559
Louisville & Nashville	5,034	3,295,952	1,100,022	4,705,215	783,388	967,395	107,306	1,567,238	14,997	95,003	3,535,326	1,169,889	184,275	985,199	54,067
Maine Central	1,209	551,698	439,932	1,066,624	141,454	139,186	9,052	378,118	8,993	24,815	701,617	365,007	52,129	312,878	55,009
Michigan Central	1,800	1,705,409	984,655	3,021,357	303,551	426,527	61,633	1,109,318	49,317	52,313	2,002,659	1,018,698	134,000	884,405	348,571
Midland Valley	380	80,364	38,518	125,783	29,346	26,971	2,072	40,830	.....	5,698	104,917	20,866	6,582	14,263	—1,008
Minneapolis & St. Louis	1,646	652,974	205,068	904,698	103,723	136,844	17,903	311,777	.....	19,609	589,855	314,843	37,320	277,523	53,000
Minn., St. Paul & Sault Ste. Marie	4,102	1,609,508	650,797	2,460,556	367,698	401,168	46,899	774,501	17,023	53,507	1,659,599	800,957	107,846	693,112	—93,260
Missouri & North Arkansas	365	61,689	42,982	111,333	30,009	21,071	3,407	52,856	.....	6,797	114,140	—2,807	6,000	—8,835	—28,538
Missouri, Kansas & Texas System	3,865	1,704,693	806,243	2,699,334	383,675	429,159	55,397	933,031	28,305	100,437	1,892,663	806,670	114,515	691,749	—69,462
Missouri, Oklahoma & Gulf	332	84,063	23,219	112,867	20,077	13,331	3,996	39,646	110	5,195	82,354	30,513	6,469	23,965	13,715
Missouri, Oklahoma & Gulf Ry. of Tex.	19	10,387	471	11,135	1,126	1,721	240	3,726	.....	448	7,260	3,875	197	3,678	2,558
Missouri Pacific	3,920	1,936,259	477,901	2,618,106	328,395	508,556	64,483	908,757	9,413	69,609	1,889,213	728,892	98,590	629,702	141,089
Mobile & Ohio	1,122	846,598	139,319	1,034,442	128,878	227,120	40,912	389,199	2,797	28,272	817,179	217,263	33,245	184,000	—52,952
Monongahela	67	90,470	2,336	95,316	14,565	8,188	470	22,451	.....	1,974	47,647	47,669	2,100	45,569	—35,303
Nashville, Chattanooga & St. Louis	1,231	637,704	264,029	985,872	136,408	216,200	45,496	386,548	13,225	28,273	826,150	159,722	27,213	132,458	—38,308
New Orleans & North Eastern	204	233,746	51,469	311,126	37,198	72,390	9,981	109,619	5,865	10,832	245,886	65,240	14,500	50,740	—34,247
New Orleans Great Northern	283	97,730	30,660	141,759	19,460	21,310	2,622	41,580	170	6,467	91,609	50,150	3,167	46,983	—14,394
New Orleans, Mobile & Chicago	403	119,717	32,042	160,765	26,063	25,712	4,046	51,670	—16	6,672	114,146	46,619	6,190	40,408	—20,157
New Orleans, Texas & Mexico	286	104,092	22,721	133,451	28,252	13,501	3,691	47,078	.....	8,013	100,536	32,915	1,621	31,294	2,884
New York Central & Hudson River	3,692	5,276,305	3,465,213	10,178,390	1,132,616	1,732,135	146,991	3,483,282	186,499	204,909	6,886,432	3,291,958	500,260	2,791,487	271,717
New York, Chicago & St. Louis	567	765,907	155,125	967,115	137,564	103,946	43,411	408,021	6,009	18,502	717,453	249,662	42,000	207,661	20,114
New York, New Haven & Hartford	2,003	2,608,446	2,583,152	5,756,909	785,240	819,010	38,714	2,082,169	47,309	132,623	3,904,412	1,852,498	220,000	1,632,239	—143,185
New York, Ontario & Western	568	554,266	317,298	1,000,730	134,906	137,182	9,403	322,794	.....	15,183	619,468	381,262	19,583	361,655	5,090
New York, Philadelphia & Norfolk	112	266,986	61,322	363,123	37,595	76,395	5,739	144,584	4,930	9,212	278,455	84,669	8,700	75,969	—13,013
New York, Susquehanna & Western	140	182,651	49,593	257,324	28,346	27,207	2,327	103,521	.....	5,304	166,705	90,619	12,583	66,640	21,477
Norfolk & Western	2,037	3,372,832	478,061	3,990,541	633,191	718,535	56,382	1,124,329	8,312	63,863	2,550,077	1,440,463	140,000	1,300,463	138,758
Norfolk Southern	860	175,023	95,059	294,802	52,354	47,395	6,189	107,184	.....	19,016	232,137	62,665	11,500	51,165	—37,956
Northern Pacific	6,409	4,036,615	1,482,049	6,075,933	1,028,985	880,394	103,681	1,791,022	95,698	87,744	3,902,995	2,172,938	401,076	1,771,762	—74,885
Northwestern Pacific	401	159,403	205,893	404,445	57,890	41,257	5,451	124,736	.....	8,954	233,500	170,945	15,985	154,960	—26,708
Oahu Ry. & Land Co.	109	146,932	23,535	175,688	10,260	9,991	615	24,025	.....	3,197	48,088	127,600	7,250	120,350	45,369
Oregon Short Line	2,163	1,397,658	465,279	2,003,113	292,739	223,876	30,792	454,346	31,063	56,446	1,070,894	932,220	116,500	815,659	49,856
Panhandle & Santa Fe	668	251,853	65,519	333,677	55,094	64,705	3,962	104,393	.....	8,469	236,624	97,053	9,234	87,763	53,022
Pennsylvania *Company*	1,750	4,018,022	977,436	5,496,066	728,752	890,374	76,756	1,770,074	38,407	108,258	3,612,621	1,883,446	275,837	1,607,415	—213,989
Pennsylvania *Railroad*	4,519	11,546,048	3,853,587	17,001,207	2,116,656	3,034,159	174,036	5,779,377	246,742	396,312	11,747,283	5,253,924	653,469	4,600,455	510,394
Pere Marquette	2,322	1,020,692	472,390	1,624,690	152,687	305,468	31,767	565,107	6,176	52,858	1,113,394	511,296	53,477	457,313	273,561
Philadelphia & Reading	1,120	3,248,971	635,409	4,069,789	468,699	753,838	51,894	1,375,118	15,089	64,591	2,729,228	1,340,561	101,492	1,238,381	—177,210
Philadelphia, Baltimore & Washington	717	955,377	760,111	1,905,048	276,583	343,566	24,539	783,104	12	40,791	1,468,595	436,453	56,230	380,223	55,249
Pittsburgh & Lake Erie	224	1,282,611	177,378	1,518,103	172,186	335,103	13,359	359,649	3,866	27,298	911,459	606,643	51,550	555,093	—171,145
Pittsburgh, Cincinnati, Chic. & St. Louis	1,472	2,420,459	793,617	3,585,260	475,428	619,574	64,552	1,203,472	25,136	75,883	2,464,045	1,121,215	164,551	956,544	40,839
Pittsburg, Shawmut & Northern	294	137,447	14,500	154,080	56,919	46,892	1,724	49,493	.....	3,924	158,952	—4,872	1,665	—6,537	—22,803
Port Reading	21	96,142	.....	115,357	23,145	9,800	38	36,306	.....	101	69,390	45,967	12,000	33,967	—2,046
Richmond, Fredericksburg & Potomac	88	111,485	72,753	207,916	20,559	31,473	3,665	81,308	292	7,087	144,384	63,532	7,637	55,873	—6,553
Rutland	468	167,327	119,216	325,279	44,829	56,509	8,891	115,569	1,362	4,983	232,143	93,137	17,088	76,049	—32,062
St. Joseph & Grand Island	319	95,992	32,793	140,171	38,198	22,638	4,930	53,019	.....	5,296	124,081	16,090	7,048	9,042	—8,210
St. Louis & San Francisco	4,746	2,368,287	1,088,661	3,667,529	491,525	562,094	63,525	1,214,393	.....	84,868	2,416,405	1,251,124	117,039	1,132,382	—90,891
St. Louis, Brownsville & Mexico	548	129,361	80,271	226,616	40,847	19,287	5,361	80,008	.....	10,745	154,113	72,502	6,750	65,752	—19,721
St. Louis, Iron Mountain & Southern	3,365	2,006,878	543,529	2,735,464	374,771	512,527	57,382	845,639	9,958	59,713	1,859,991	875,473	112,832	761,909	—91,917
St. Louis Merchants' Bridge Terminal	9	.....	290	165,731	18,954	6,845	753	76,633	.....	6,419	109,605	56,127	8,080	48,047	24,584

REVENUES AND EXPENSES OF RAILWAYS

MONTH OF AUGUST, 1914—CONTINUED

Name of road.	Average mileage operated during period.	Operating revenues			Operating expenses							Net operating revenue (or deficit).	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
		Freight.	Passenger.	Total. inc. misc.	Maintenance: Way and structures.	Maintenance: Of equipment.	Traffic.	Transportation.	Miscellaneous.	General.	Total.				
St. Louis, San Francisco & Texas	244	$67,426	$29,640	$105,024	$33,269	$16,417	$2,510	$53,644	.....	$5,316	$111,157	—$6,133	$1,327	—$7,460	—$51,037
St. Louis Southwestern	943	477,515	124,958	636,948	72,369	107,070	24,543	165,157	$3,907	23,395	396,717	240,231	29,626	210,600	—95,512
St. Louis Southwestern of Texas	811	187,629	104,661	317,019	83,780	81,030	10,946	142,492	958	15,427	333,561	—16,542	13,500	—30,045	—18,445
San Antonio & Aransas Pass	724	211,541	127,443	360,988	65,199	69,258	6,691	163,394	.....	11,294	315,835	45,153	12,000	33,153	—161,051
San Pedro, Los Angeles & Salt Lake	1,132	473,824	231,488	770,009	83,326	136,265	32,572	248,592	13,678	17,608	532,040	237,968	40,712	197,166	—37,149
Seaboard	3,098	1,069,816	442,781	1,690,828	202,169	281,162	63,741	628,742	6,838	54,095	1,236,747	454,081	91,000	363,018	—51,327
Southern	7,036	3,398,839	1,833,047	5,688,044	824,967	1,086,515	197,553	2,068,216	34,412	165,706	4,361,761	1,326,284	220,195	1,105,153	—292,287
Southern in Mississippi	281	46,552	36,670	90,613	24,013	8,951	2,120	41,887	.....	3,528	80,500	10,113	7,750	2,314	2,695
Southern Pacific	6,492	5,434,907	2,545,643	8,709,348	958,856	1,293,928	153,979	2,699,373	141,167	234,250	5,471,743	3,237,606	425,541	2,810,468	—365,049
Spokane International	163	68,279	18,541	90,776	11,984	4,950	2,477	23,531	.....	4,013	46,955	43,821	4,604	39,217	3,181
Spokane, Portland & Seattle	556	240,611	172,259	461,246	49,177	34,020	9,410	94,143	3,988	13,516	204,254	256,992	53,400	203,548	2,980
Tennessee Central	294	93,493	39,049	140,625	31,058	16,014	5,404	53,137	.....	6,658	112,271	28,354	4,480	23,868	—13,437
Terminal R. R. Ass'n of St. Louis	35	.....	169	242,748	13,975	9,759	897	77,429	.....	4,562	106,623	136,126	28,309	107,817	50,867
Texas & New Orleans	463	219,799	107,046	365,345	62,084	77,220	7,764	149,156	15,510	10,033	321,686	43,660	15,793	27,535	—15,762
Texas & Pacific	1,886	917,149	420,046	1,448,540	166,912	253,442	37,346	599,538	14,949	36,622	1,108,632	339,908	68,700	271,186	—5,309
Toledo & Ohio Central	446	449,212	64,235	544,932	55,362	78,641	6,690	170,799	1,759	10,843	324,094	220,838	21,348	199,491	86,922
Toledo, St. Louis & Western	451	340,917	42,079	410,997	46,973	66,442	15,827	138,992	.....	7,879	276,114	134,884	20,500	114,384	—36,330
Toledo, Peoria & Western	248	68,449	42,968	116,977	18,301	22,744	2,373	43,854	.....	3,639	90,909	26,067	6,100	19,967	11,093
Trinity & Brazos Valley	315	55,291	21,015	83,193	14,305	3,756	2,954	41,639	.....	7,936	70,591	12,603	4,900	7,703	7,156
Ulster & Delaware	129	50,237	67,614	135,028	20,939	12,082	2,074	53,380	50	2,740	91,264	43,763	3,300	40,463	—7,288
Union Pacific	3,615	3,501,722	972,711	4,929,305	651,891	615,578	81,940	1,104,631	76,614	121,838	2,648,886	2,280,419	182,119	2,097,755	32,376
Union R. R. of Baltimore	9	108,972	23,588	134,358	14,185	.....	.....	4,386	.....	2,234	20,804	113,554	6,180	107,374	—8,818
Union R. R. of Pennsylvania	31	.....	.....	406,263	67,724	99,961	100	141,842	.....	2,713	312,340	93,923	2,700	91,223	—54,252
Vandalia	910	677,034	229,187	1,004,976	137,447	192,876	23,243	359,123	11,954	20,601	745,244	259,732	32,291	227,441	—7,369
Vicksburg, Shreveport & Pacific	171	64,551	55,467	132,528	24,293	29,487	3,693	46,469	2,707	4,837	111,487	21,042	7,200	13,842	—14,056
Virginia & Southwestern	240	156,530	16,515	178,076	26,068	39,251	2,465	48,239	.....	3,737	119,760	58,315	6,250	52,065	—1,356
Virginian	503	477,097	42,906	554,342	66,865	88,834	5,921	121,017	12,608	9,867	299,772	254,570	22,500	232,070	—5,912
Washington Southern	36	35,808	36,389	95,941	12,203	15,206	1,440	39,450	118	2,896	71,314	24,627	3,320	21,303	10
West Jersey & Seashore	356	185,781	745,086	1,010,298	108,486	104,940	12,449	281,541	3,379	12,550	523,345	486,953	26,959	459,931	—28,283
Western Maryland	661	603,721	123,214	763,128	104,081	124,552	21,200	266,677	3,094	19,105	537,209	225,919	24,500	201,419	53,175
Western Ry. of Alabama	133	55,383	40,519	105,950	20,447	28,476	6,136	32,784	2,362	4,268	94,473	11,477	5,008	6,436	—6,906
Yazoo & Mississippi Valley	1,372	639,077	230,918	925,111	156,039	155,013	18,068	356,071	871	21,806	704,803	220,309	50,000	170,220	30,325
Wabash	2,518	1,875,097	686,694	2,792,630	330,589	445,946	85,731	1,011,894	15,929	59,709	1,944,966	847,664	83,657	763,828	20,356
Western Pacific	943	390,507	129,233	553,804	143,661	62,400	24,866	164,636	12,815	20,671	429,048	124,756	30,009	94,743	—81,880
Wheeling & Lake Erie	459	404,566	67,596	516,541	73,536	85,355	9,606	181,966	1,566	15,059	367,088	149,453	32,232	117,221	—91,026
TWO MONTHS OF FISCAL YEAR ENDING JUNE 30, 1915															
Alabama & Vicksburg	143	$156,899	$86,399	$268,036	$44,230	$68,225	$7,341	$95,512	$6,315	$11,013	$232,635	$35,400	$14,480	$20,920	—$19,945
Alabama Great Southern	309	575,106	231,284	879,011	101,188	220,840	26,799	291,759	7,593	18,002	666,180	212,831	30,986	181,814	—68
Atchison, Topeka & Santa Fe	8,405	10,760,520	4,315,123	16,307,296	2,377,224	2,783,164	328,596	4,495,067	.....	292,383	10,271,475	6,035,821	798,274	5,235,797	592,168
Atlanta & West Point	93	93,966	89,236	206,823	35,398	51,423	10,744	64,478	2,983	8,713	173,739	33,084	14,250	18,811	—4,738
Atlanta, Birmingham & Atlantic	646	330,425	133,029	504,406	78,685	84,329	27,920	203,578	.....	20,883	415,395	89.011	28,674	60,116	13,639
Atlantic & St. Lawrence	167	154,300	71,518	244,694	42,575	32,006	7,901	105,882	.....	5,836	194,200	50,494	21,600	28,894	23,911
Atlantic City	170	156,273	595,367	778,232	51,846	56,974	8,356	306,009	119	4,970	428,274	349,958	27,000	322,940	—61,201
Atlantic Coast Line	4,664	2,968,096	1,385,292	4,751,905	893,490	999,713	104,020	1,906,814	13,182	153,566	4,055,986	695,920	276,000	417,371	—95,477
Baltimore & Ohio—System	4,516	12,593,452	3,066,349	16,847,064	1,689,340	3,166,560	328,965	6,184,617	92,487	345,756	11,807,725	5,039,340	528,926	4,510,025	—613,108
Baltimore & Ohio Chicago Terminal	79	.....	1,640	286,032	33,389	38,827	1,890	113,698	8,319	9,856	205,979	80,053	38,042	42,010	—7,329
Bangor & Aroostook	631	321,682	124,603	477,565	104,889	93,659	5,623	162,051	3,064	18,744	388,030	89,536	17,500	72,032	5,589
Belt Ry. Co. of Chicago	24	.....	.....	559,752	43,204	46,577	2,068	176,690	.....	11,885	280,424	279,328	24,227	255,102	83,171
Bessemer & Lake Erie	204	2,139,624	98,111	2,269,071	156,772	354,070	18,484	410,628	4,702	22,467	966,934	1,302,137	36,000	1,266,134	196,050
Bingham & Garfield	27	260,628	10,035	272,382	27,412	37,401	1,768	44,841	211	3,839	115,471	156,910	4,500	152,410	—4,682
Birmingham Southern	43	94,430	2,477	174,696	35,089	30,946	915	60,714	.....	6,678	134,343	40,353	3,437	36,915	—47,770
Boston & Maine	2,252	4,606,226	3,271,432	8,606,988	1,355,763	1,488,670	92,879	3,504,750	40,880	189,223	6,672,165	1,934,823	342,140	1,592,683	—576,859
Buffalo & Susquehanna R. R. Corporation	253	237,630	16,121	259,521	52,573	75,385	2,252	76,398	.....	10,710	217,319	42,202	5,200	37,002	.....
Buffalo & Susquehanna Ry	91	31,224	19,112	55,640	14,114	20,296	1,028	24,845	141	5,219	65,642	—10,002	3,200	—13,202	—1,155
Buffalo, Rochester & Pittsburgh	586	1,608,133	241,781	1,922,137	308,662	452,663	23,498	545,236	2,837	35,836	1,368,731	553,406	40,000	513,395	—139,003
Canadian Pacific Lines in Maine	233	81,406	40,124	134,989	49,963	30,760	13,345	64,454	.....	7,407	165,930	—30,941	24,000	—54,941	15,998
Carolina, Clinchfield & Ohio	248	326,695	42,385	379,069	37,700	48,054	13,879	93,041	.....	17,267	186,099	192,971	28,500	164,435	—94,696
Carolina, Clinchfield & Ohio of S. C.	18	17,753	3,819	22,097	1,933	201	3,616	4,219	.....	1,116	11,085	11,012	1,500	9,512	—6,028
Central of Georgia	1,924	1,313,878	685,028	2,197,875	314,515	432,694	73,211	774,987	2,962	67,952	1,666,275	531,600	104,720	426,865	219,098
Central of New Jersey	678	3,453,057	1,460,899	5,196,715	478,982	860,579	59,701	1,714,363	26,517	98,861	3,238,921	1,957,795	224,752	1,733,018	—288,888
Central New England	304	471,914	92,107	591,870	165,782	72,757	2,166	198,520	.....	7,828	447,023	144,846	22,000	122,846	—117,292
Central Vermont	411	453,840	186,821	698,057	119,959	108,320	17,614	301,539	5,982	13,153	566,567	131,490	31,520	99,970	26,140
Charleston & Western Carolina	341	200,822	73,148	289,084	65,076	57,193	9,024	114,023	.....	8,433	253,749	35,335	10,000	25,335	—19,370
Chesapeake & Ohio Lines	2,367	5,184,659	1,204,736	6,783,155	818,756	1,454,865	113,629	2,117,197	44,972	142,216	4,691,635	2,091,519	219,844	1,871,675	25,652
Chicago & Eastern Illinois	1,282	1,937,153	561,020	2,700,965	293,952	524,424	44,099	912,769	15,901	69,755	1,860,900	840,065	113,800	726,182	262,991
Chicago & Erie	270	754,421	121,752	961,004	171,586	239,193	40,233	472,318	4,210	27,317	954,857	6,147	25,790	—19,685	41,988
Chicago & Northwestern	8,108	9,092,850	4,453,498	15,078,959	2,626,180	2,246,973	231,708	4,916,986	115,370	281,294	10,418,511	4,660,448	750,000	3,909,976	152,809
Chicago, Burlington & Quincy	9,264	10,939,282	4,283,167	16,603,955	2,018,587	2,779,252	280,952	4,782,401	135,999	340,550	10,337,741	6,266,214	665,056	5,601,158	80,343
Chicago, Detroit & Can. Gd. Trunk Jctn.	60	90,932	40,954	161,837	21,957	20,437	3,480	76,449	509	2,568	125,401	36,436	5,740	30,696	—300
Chicago Great Western	1,427	1,578,521	607,590	2,391,866	373,474	391,675	101,647	808,772	13,758	68,882	1,755,991	635,876	97,337	537,354	—140,032

REVENUES AND EXPENSES OF RAILWAYS

TWO MONTHS OF FISCAL YEAR ENDING JUNE 30, 1915—CONTINUED

Name of road.	Average mileage operated during period.	Operating revenues			Operating expenses							Net operating revenue (or deficit).	Railway tax accruals.	Operating income (or loss).	Increase (or decr.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total. inc. misc.	Way and structures.	Of equipment.	Traffic.	Trans-portation.	Miscel-laneous.	General.	Total.				
Chicago, Indiana & Southern	359	$594,003	$61,358	$681,433	$105,615	$181,549	$12,712	$226,469	$3,330	$27,776	$557,451	$123,982	$37,300	$86,580	$28,572
Chicago Junction	12	.....	.....	318,766	42,283	36,145	1,945	164,099	.....	9,389	253,861	64,905	4,428	60,426	—54,246
Chicago, Milwaukee & St. Paul	9,987	10,625,972	3,741,568	16,014,187	2,223,954	2,201,948	309,983	5,904,577	142,085	277,348	10,638,851	5,375,336	833,750	4,531,091	398,969
*Chicago, Peoria & St. Louis	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chicago, Rock Island & Gulf	477	336,333	111,769	481,994	74,021	66,767	19,024	193,331	3,708	14,816	371,668	110,327	17,629	92,651	—7,655
Chicago, Rock Island & Pacific	7,852	7,839,294	3,535,601	12,221,794	1,870,996	2,129,007	291,435	4,588,913	92,330	272,930	9,232,245	2,989,550	462,861	2,526,005	293,951
Chicago, St. Paul, Minn. & Omaha	1,753	1,916,374	1,081,573	3,235,897	466,657	424,563	59,550	1,067,758	33,682	70,609	2,123,819	1,113,078	178,368	934,395	337,907
Chicago, Terre Haute & Southeastern	375	338,136	39,075	388,944	62,752	72,927	5,738	105,058	1,626	18,951	267,051	121,893	23,000	98,893	47,742
Cincinnati, Hamilton & Dayton	1,015	1,403,530	316,047	1,916,194	263,727	313,347	39,071	796,371	.....	36,728	1,449,243	466,950	75.453	390,535	102,777
Cincinnati, New Orleans & Texas Pacific	337	1,274,833	297,753	1,660,287	172,917	453,406	49,549	508,195	5,401	41,157	1,230,626	429,661	62,000	367,661	—83,215
Cincinnati Northern	246	218,462	55,978	287,622	41,802	51,484	5,131	90,637	.....	6,603	195,657	91,965	12,000	79,852	91,410
Cleveland, Cincinnati, Chic. & St. Louis	2,361	4,216,775	1,734,494	6,514,148	723,049	1,287,402	149,572	2,380,579	54,125	126,993	4,712,438	1,801,710	254,500	1,546,379	910,478
Colorado Midland	338	226,521	74,750	336,710	73,041	78,520	17,000	135,465	5,129	11,580	320,734	15,976	17,060	—1,084	25,045
Colorado & Southern	1,127	834,396	358,494	1,286,171	220,188	318,855	23,537	404,448	11,239	38,029	1,016,296	269,874	71,250	198,507	—220,410
Cumberland Valley	164	367,664	127,412	522,736	104,381	61,227	8,713	169,540	1,598	14,201	359,660	163,076	11,821	151,255	—22,798
Delaware, Lackawanna & Western	960	5,026,375	1,710,974	7,467,622	1,097,283	1,170,276	144,739	2,254,881	72,859	143,023	4,845,615	2,622,007	370,000	2,251,744	—129,805
Denver & Rio Grande	2,562	2,840,496	978,067	4,093,487	808,151	756,060	82,678	1,149,534	71,781	109,080	2,975,997	1,117,490	180,000	937,373	—28,986
Denver & Salt Lake	255	199,368	109,890	328,136	39,245	55,094	6,313	96,507	.....	11,942	208,495	119,641	9,000	110,641	—9,146
Detroit & Mackinac	400	115,765	72,348	205,715	25,889	32,344	4,163	69,012	778	5,227	137,415	68,301	18,297	50,003	—18,994
Detroit & Toledo Shore Line	79	206,465	.....	207,132	29,661	18,654	3,005	62,542	.....	5,128	118,989	88,143	11,800	76,343	—34,850
Detroit, Grand Haven & Milwaukee	191	268,000	129,000	452,319	83,285	64,640	14,159	208,964	2,483	9,260	382,791	69,528	6,720	62,808	—20,170
Detroit, Toledo & Ironton	441	268,750	38,666	327,722	47,353	40,117	6,454	159,416	.....	12,570	265,910	61,812	12,000	49,812	147,090
Duluth & Iron Range	292	1,404,627	41,387	1,497,952	204,247	152,365	2,998	268,983	6,838	17,006	652,437	845,515	79,936	765,579	—661,309
Duluth, Missabe & Northern	364	1,586,258	64,312	1,691,831	180,159	164,740	4,452	257,980	7,654	18,914	633,899	1,057,933	84,868	973,065	—643,420
Duluth, South Shore & Atlantic	627	327,398	207,096	594,444	124,999	76,819	16,189	202,794	8,920	26,201	455,923	138,521	38,000	100,507	—37,668
Duluth, Winnipeg & Pacific	181	187,544	39,474	231,644	68,142	47,020	5,716	85,476	775	13,020	220,149	11,495	11,582	—87	—73,636
El Paso & Southwestern Co	1,029	1,107,501	229,915	1,445,069	180,552	199,257	36,674	389,046	11,913	44,464	861,906	583,163	76,421	506,462	118,188
Elgin, Joliet & Eastern	777	1,536,521	11	1,631,920	184,873	290,832	10,167	437,937	.....	34,537	958,233	673,687	65,666	608,021	—138,351
Erie	1,988	7,137,160	1,973,287	9,947,343	1,103,054	2,027,631	185,501	3,322,309	72,660	196,140	6,892,154	3,055,190	277,093	2,777,746	—88,219
Florence & Cripple Creek	87	152,872	50,215	206,477	27,001	19,467	4,053	67,188	.....	8,937	126,646	79,830	11,353	68,477	—50,261
Florida East Coast	696	287,837	225,594	591,159	128,749	99,429	11,746	247,432	2,937	25,388	505,027	86,133	40,000	46,109	109,126
Fort Worth & Denver City	454	523,195	301,191	873,810	87,277	138,092	19,826	329,751	7,152	27,890	609,989	263,821	25,839	237,982	51,586
Galveston, Harrisburg & San Antonio	1,338	1,319,980	550,050	2,011,013	289,834	356,561	55,598	817,983	18,656	67,004	1,603,704	407,310	78,851	328,217	—13,234
Georgia	307	296,511	168,800	506,652	62,164	102,034	25,720	228,212	.....	15,832	433,961	72,691	6,878	65,813	34,654
Georgia, Southern & Florida	395	222,894	134,051	405,434	52,798	90,749	15,352	161,140	.....	18,081	338,120	67,314	21,885	45,360	20,666
Grand Rapids & Indiana	575	492,306	468,923	1,049,719	113,654	132,241	19,540	395,896	6,871	26,798	695,000	354,719	48,442	306,277	87,039
Grand Trunk Western	347	826,000	395,000	1,292,208	197,185	239,403	39,894	489,660	22,153	29,613	1,017,907	274,301	71,840	202,461	33,375
Great Northern	8,016	9,467,017	2,942,768	13,757,102	1,631,901	1,342,958	221,683	3,314,062	165,055	218,366	6,884,831	6,872,272	752,897	6,119,029	459,602
Gulf & Ship Island	308	215,530	66,481	300,446	38,808	58,035	5,169	76,936	557	14,665	194,171	106,274	14,670	91,559	—48,533
Gulf, Colorado & Santa Fe	1,937	2,016,499	636,463	2,792,551	345,490	416,131	55,930	941,271	.....	67,037	1,825,859	966,692	102,111	864,582	423,332
Hocking Valley	353	900,103	168,947	1,162,450	171,735	198,278	16,492	354,548	.....	25,503	766,555	395,895	77,600	318,295	—173,448
Houston, East & West Texas	191	155,399	74,092	240,624	46,498	27,242	4,012	85,912	.....	5,692	169,144	71,480	8,498	62,949	20,858
Houston & Texas Central	852	734,263	332,566	1,143,579	186,167	162,076	31,109	453,991	3,214	32,894	869,012	274,567	48,094	226,210	43,786
Illinois Central	4,769	7,879,040	2,500,501	11,241,473	1,746,655	2,605,229	196,450	3,887,716	60,431	241,133	8,719,847	2,521,626	550,000	1,966,605	206,320
Indiana Harbor Belt	105	.....	.....	565,981	89,170	70,746	5,040	222,087	.....	15,551	402,594	163,387	15,570	147,725	23,671
International & Great Northern	1,160	975,120	384,711	1,466,283	277,112	258,046	51,821	779,094	5,717	66,394	1,438,183	28,101	50,000	—22,055	—348,220
Kanawha & Michigan	177	526,009	65,779	604,881	73,694	131,172	4,938	160,972	9	13,264	384,049	220,832	23,662	197,171	485
Kansas City Southern	827	1,365,575	302,662	1,830,909	205,551	219,306	52,796	577,165	.....	83,538	1,136,977	693,932	93,833	599,734	22,515
Lake Erie & Western	906	853,506	170,647	1,074,560	142,690	147,068	26,540	383,034	.....	23,356	722,689	351,870	48,500	302,438	163,693
Lake Shore & Michigan Southern	1,852	5,562,124	2,611,934	9,392,327	1,057,846	1,805,015	146,431	3,057,861	112,170	180,621	6,359,944	3,032,383	393,000	2,637,848	—263,192
Lehigh & Hudson River	97	270,211	21,740	296,480	46,028	39,290	2,667	102,216	.....	7,116	197,318	99,162	8,300	90,862	37,836
Lehigh & New England	296	435,595	2,824	458,606	61,740	63,563	3,653	108,467	.....	12,191	249,613	208,992	11,340	197,653	93,743
Lehigh Valley	1,444	5,972,380	960,913	7,352,428	817,828	1,451,325	154,611	2,421,699	29,964	137,673	5,013,099	2,339,329	277,000	2,061,010	—127,931
Long Island	398	613,405	2,045,734	3,025,083	241,905	249,153	31,896	993,190	12,059	56,372	1,584,575	1,440,508	130,724	1,309,154	123,572
Louisiana & Arkansas	279	272,016	48,202	329,116	61,328	50,432	5,189	79,566	.....	8,461	204,976	124,140	12,500	111,640	8,313
Louisiana Ry. & Navigation	351	270,323	51,631	342,382	69,202	31,527	11,090	125,284	.....	9,805	246,908	95,474	17,000	78,474	19,938
Louisville & Nashville	5,013	6,697,007	2,195,572	9,508,858	1,504,183	1,952,926	221,528	3,169,260	30,847	205,171	7,083,916	2,424,942	368,550	2,055,536	180,438
Maine Central	1,209	1,094,346	829,760	2,081,493	303,472	277,799	20,186	748,781	18,711	50,953	1,420,902	660,591	104,259	556,332	97,219
Michigan Central	1,800	3,273,976	1,928,694	5,859,699	640,150	878,849	125,497	2,188,251	96,594	106,205	4,035,546	1,824,152	268,000	1,555,860	472,832
Midland Valley	380	148,036	80,753	242,050	56,338	53,529	4,018	82,742	.....	11,239	207,866	34,184	13,164	186	20,834
Minneapolis & St. Louis	1,646	1,204,859	387,107	1,689,445	207,323	261,175	37,131	594,887	76	36,635	1,137,227	552,219	74,160	478,059	56,921
Minn., St. Paul & Sault Ste. Marie	4,102	3,249,062	1,296,716	4,946,058	730,277	766,627	97,440	1,527,577	35,051	100,425	3,251,942	1,694,116	219,425	1,474,690	—115,529
Missouri & North Arkansas	365	126,912	83,170	223,373	60,453	43,146	8,431	95,961	.....	12,412	220,403	2,970	12,000	—9,196	—40,392
Missouri, Kansas & Texas System	3,865	3,449,633	1,582,094	5,416,034	751,758	836,416	112,737	1,965,570	58,371	189,272	3,866,330	1,549,705	227,448	1,321,448	—55,562
Missouri, Oklahoma & Gulf	332	157,811	46,446	213,823	38,762	30,358	8,320	84,539	181	10,860	173,020	40,804	12,931	27,746	9,919
Missouri, Oklahoma & Gulf Ry. of Tex.	19	19,819	931	21,336	2,813	4,445	437	8,438	.....	1,124	17,258	4,078	394	3,685	2,637
Missouri Pacific	3,920	3,769,536	954,801	5,136,010	635,094	964,595	121,280	1,806,902	18,935	139,756	3,676,562	1,459,449	197,180	1,261,530	258,206
Mobile & Ohio	1,122	1,755,936	269,175	2,133,048	256,658	453,385	83,443	797,822	6,127	57,601	1,655,037	478,012	66,490	411,501	—60,287

*Receivers took charge of property August 1, 1914—no figures shown for the two months.

taker, and those who are careless, thoughtless or indifferent to safety. Let us spread the gospel of safety broadcast and train our citizens, both present and future, to think before they act and not go mechanically and irresistibly into certain danger where danger is known to exist.

American Association of Railway Surgeons

The eleventh annual meeting of the American Association of Railway Surgeons was held at the Hotel Sherman, Chicago, on October 14, 15, and 16. In addition to a large number of technical medical and surgical papers the following were presented: "Lighting as a Preventive of Accidents in Car Shops," by J. R. Cravath, consulting engineer, Chicago; Lantern demonstration of special qualities of glass used in railway signaling and worn for protection of employees, by Dr. Nelson Miles Black, of Milwaukee, Wis.; "Why a Railway Surgeon," by M. C. Murphy (I. C.) Morgantown, Ind.; "The Company Surgeon," by Charles Blickensderfer (C. R. I. & P.) Shawnee, Okla.; "Ethics of the Railway Surgeon," by William Reid (M. St. P. & S. S. M.) Deerwood, Minn.; "The Railway Surgeon at Terminal Points," James M. Miller (C. & E. I.) Villa Grove, Ind.; "Prevention as Applied to Railway Surgery," M. J. Kenefick (C. M. & St. P.) Algona, Iowa; "Advisability of Repeated Examinations of Employees Connected with the Operating Department of a Railway System," by F. M. Crain (C. & N. W.) Redfield, S. D.; "Railway Sanitation," D. J. McGurren (M. St. P. & S. S. M.) Devil's Lake, N. D.; "Psychology of Railway Accidents," by J. H. Sealy (C. & N. W.) Freeport, Ill. At the concluding session Dr. John B. Murphy of Chicago, consulting surgeon of the Soo Line and Illinois Central, presented a paper on "Management of Joint Injuries in Railway Accidents," and the safety first movement was discussed by R. C. Richards, general claim agent of the Chicago & North Western; Peter M. Hoffman, coroner of Cook county; L. F. Shedd, safety supervisor, Rock Island Lines, and H. L. Brownell, safety inspector, Chicago surface lines.

Officers were elected as follows: President, Dr. G. F. Beasley, surgeon for the Chicago, Indianapolis & Louisville and the Cleveland, Cincinnati, Chicago & St. Louis at Lafayette, Ind.; vice-president, Dr. J. P. Kaster, Toledo, Ohio; secretary-treasurer, Louis J. Mitchell, Chicago.

Association of Railway Electrical Engineers

The annual convention of the Association of Railway Electrical Engineers is to be held at the Hotel La Salle, Chicago, on October 26-30. An exhibit of supplies will be held on the nineteenth floor of the hotel in connection with the convention. At the first session on Tuesday morning President C. R. Gilman, illuminating engineer of the Chicago, Milwaukee & St. Paul, will present the opening address, which will be followed by reports of the committee on Loose Leaf Binders for Filing Specifications and to Keep Specification Standards to Date, the committee on Reciprocal Relations, the committee on Specifications for Wire Crossings for Potentials above 100 Volts, and the committee on Data and Information. On Wednesday reports will be presented by the committees on Standards, Electric Headlights, Industrial Trucks, Electric Traction and Wire Specifications, and at the morning session Dr. F. H. Milner, experimental engineer of the Union Pacific, will present a paper on "Communication to and between Trains by Telegraph Wireless, Telephone Wireless and Telephone." At the session on Thursday reports will be presented by the committees on Axle Equipment, Head End Equipment and Standard Rules for Car Wiring, Outside Construction and Yard Lighting, Illumination and Shop Practice, and Yard Facilities. At the Friday session reports will be presented by the committee on Yard Facilities for Charging.

National Council for Industrial Safety

At the third annual safety congress of the National Council for Industrial Safety held at the Hotel LaSalle, Chicago, on October 13, 14 and 15, one session on Thursday afternoon was devoted to transportation and public service. Martin J. Insull, vice-president of the Middle West Utilities Company, Chicago, acted as chairman of the session and presented an address on "Safety as a Means of Bettering the Relation Between the Public and Public Service Corporations." W. B. Spaulding, chairman of the central safety committee of the St. Louis & San Francisco, St. Louis, Mo., also presented an address on "The Safety Problem of the Railroads." This was discussed by R. H. Newbern, superintendent of the insurance department of the Pennsylvania Lines, who described the methods of keeping accident statistics on the Pennsylvania, and by M. A. Dow, general safety agent, New York Central Lines, who explained the necessity for the education of the public concerning the danger of careless habits, particularly in connection with highway crossing accidents. He said that out of observations of 7,779 persons crossing the tracks at various places on the lines of the New York Central during one day last December, only 359, or less than 5 per cent, looked in both directions before crossing.

MEETINGS AND CONVENTIONS

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass. Next convention, May 4-7, 1915, Hotel Sherman, Chicago.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Demurrage Commissioner, Boston, Mass. Annual convention in April.

AMERICAN ASSOCIATION OF DINING CAR SUPERINTENDENTS.—H. C. Boardman, D. L. & W., Hoboken, N. J. Next convention, October 22-24, Washington, D. C.

AMERICAN ASSOCIATION OF FREIGHT AGENTS.—R. O. Wells, Illinois Central, East St. Louis, Ill. Annual meeting, May 21-24, 1915, Richmond, Va.

AMERICAN ASSOCIATION OF GENERAL PASSENGER AND TICKET AGENTS.—W. C. Hope, C. R. R. of N. J., 143 Liberty St., New York.

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.—E. H. Harman, Room 101, Union Station, St. Louis, Mo. Next meeting, May 20-21, 1915, San Francisco, Cal.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.—E. B. Burritt, 29 W. 39th St., New York.

AMERICAN ELECTRIC RAILWAY MANUFACTURERS' ASSOCIATION.—H. C. McConnaughy, 165 Broadway, New York. Meetings with American Electric Railway Association.

AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 75 Church St., New York. Semi-annual meeting, November 18, Chicago.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—C. A. Lichty, C. & N. W., Chicago.

AMERICAN RAILWAY ENGINEERING ASSOCIATION.—E. H. Fritch, 900 S. Michigan Ave., Chicago. Next convention, March 16-18, 1915, Chicago.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Annual meeting, June, 1915.

AMERICAN RAILWAY SAFETY ASSOCIATION.—L. F. Shedd, C. R. I. & P., Chicago. Next meeting, November, Chicago.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—A. R. Davis, Central of Georgia, Macon, Ga. Annual meeting, July, 1915.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Chas. W. Hunt, 220 W. 57th St., New York. Regular meetings, 1st and 3d Wednesday in month, except June, July and August, 220 W. 57th St., New York.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.—J. R. Wemlinger, 11 Broadway, New York. Regular meetings, 2d Thursday in month, at 2 P. M., 11 Broadway, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., New York. Annual meeting, December 1-4, 1914, New York.

AMERICAN WOOD PRESERVERS' ASSOCIATION.—F. J. Angier, B. & O., Mt. Royal Sta., Baltimore, Md. Next convention, January 19-21, 1915, Chicago.

ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—E. R. Woodson, 1300 Pennsylvania Ave., N. W., Washington, D. C. Annual convention, April 28, 1915, Atlanta, Ga.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS.—George W. Lyndon, 1214 McCormick Bldg., Chicago. Annual meeting, second Tuesday in October, New York.

ASSOCIATION OF RAILWAY CLAIM AGENTS.—C. W. Egan, B. & O., Baltimore, Md. Annual meeting, 3d week in May, 1915, Galveston, Tex.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Jos. A. Andreucetti, C. & N. W., Room 411, C. & N. W. Sta., Chicago. Annual convention October 26-30, 1914, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, Soo Line, 112 West Adams St., Chicago. Annual meeting, June 22-25, 1915, Rochester, N. Y.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 75 Church St., New York. Next morning, December 8-9, 1914, Richmond, Va.

BRIDGE AND BUILDING SUPPLY MEN'S ASSOCIATION.—L. D. Mitchell, Detroit Graphite Co., Chicago, Ill. Meetings with American Railway Bridge and Building Association.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk, P. O. Box 7, St. Lambert (near Montreal), Que. Regular meetings, 2d Tuesday in month, except June, July and August, Windsor Hotel, Montreal, Que.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 176 Mansfield St., Montreal, Que. Regular meetings, 1st Thursday in October, November, December, February, March and April. Annual meeting, January, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 Lawler Ave., Chicago. Regular meetings, 2d Monday in month, except July and August, Lytton Bldg., Chicago.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York. Regular meetings, 2d Friday in January, May, September and November. Annual meetings, 2d Thursday in March, Hotel Statler, Buffalo, N. Y.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—Elmer K. Hiles, 2511 Oliver Bldg., Pittsburgh, Pa. Regular meetings, 1st and 3d Tuesday, Pittsburgh.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, R. F. & P., Richmond, Va. Annual meeting, June 16, 1915, Chicago.

GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—A. M. Hunter, 321 Grand Central Station, Chicago. Regular meetings, Wednesday, preceding 3d Thursday in month, Room 1856, Transportation Bldg., Chicago.

INTERNATIONAL RAILWAY CONGRESS.—Executive Committee, 11, Rue de Louvain, Brussels, Belgium. Next convention, June 23 to July 6, 1915, Berlin.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. G. Hall, C. & E. I., 922 McCormick Bldg., Chicago. Annual meeting, May 17-20, 1915, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—Wm. Hall, 829 W. Broadway, Winona, Minn. Next convention, July 14-17, 1915, Sherman House, Chicago.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, C. H. & D., Lima, Ohio.

MAINTENANCE OF WAY AND MASTER PAINTERS' ASSOCIATION OF THE UNITED STATES AND CANADA.—T. I. Goodwin, C. R. I. & P., Eldon, Mo. Next convention, November 17-19, 1914, Detroit, Mich.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York. Annual convention, May, 1915.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION OF THE UNITED STATES AND CANADA.—A. P. Dane, B. & M., Reading, Mass.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Annual meeting, June, 1915.

NATIONAL RAILWAY APPLIANCES ASSOCIATION.—Bruce V. Crandall, 537 So. Dearborn St., Chicago. Next convention, March 15-19, 1915, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meetings, 2d Tuesday in month, except June, July, August and September, Boston.

NEW YORK RAILROAD CLUB.—Harry D. Vought, 95 Liberty St., New York. Regular meetings, 3d Friday in month, except June, July and August, 29 W. 39th St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—E. Frankenberger, 623 Brisbane Bldg., Buffalo, N. Y. Meetings monthly.

PEORIA ASSOCIATION OF RAILROAD OFFICERS.—M. W. Rotchford, Union Station, Peoria, Ill. Regular meetings, 2d Thursday in month, Jefferson Hotel, Peoria.

RAILROAD CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City, Mo. Regular meetings, 3d Friday in month, Kansas City.

RAILROAD MASTER TINNERS, COPPERSMITHS AND PIPEFITTERS' ASSOCIATION.—U. G. Thompson, C. & E. I., Danville, Ill. Annual meeting, May, 1915.

RAILWAY BUSINESS ASSOCIATION.—Frank W. Noxon, 30 Church St., New York. Annual meeting, December 10, 1914, Waldorf-Astoria Hotel, New York.

RAILWAY CLUB OF PITTSBURGH.—J. B. Anderson, Room 207, P. R. R. Sta., Pittsburgh, Pa. Regular meetings, 4th Friday in month, except June, July and August, Monongahela House, Pittsburgh.

RAILWAY ELECTRICAL SUPPLY MANUFACTURERS' ASSOCIATION.—J. Scribner, 1021 Monadnock Block, Chicago. Meetings with Association of Railway Electrical Engineers.

RAILWAY FIRE PROTECTION ASSOCIATION.—C. B. Edwards, Fire Ins. Agt., Mobile & Ohio, Mobile, Ala.

RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, Times Bldg., Bethlehem, Pa.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, L. S. & M. S., Box C, Collinwood, Ohio. Annual meeting, May, 1915.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 2136 Oliver Bldg., Pittsburgh, Pa. Meetings with Master Car Builders and Master Mechanics Associations.

RAILWAY TELEGRAPH AND TELEPHONE APPLIANCE ASSOCIATION.—G. A. Nelson, 50 Church St., New York. Meetings with Association of Railway Telegraph Superintendents.

RICHMOND RAILROAD CLUB.—F. O. Robinson, C. & O., Richmond, Va. Regular meetings, 2d Monday in month, except June, July and August.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—L. C. Ryan, C. & N. W., Sterling, Ill.

ST LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, 2d Friday in month, except June, July and August, St. Louis.

SALT LAKE TRANSPORTATION CLUB.—R. E. Rowland, Hotel Utah Bldg., Salt Lake City, Utah. Regular meetings, 1st Saturday of each month, Salt Lake City.

SIGNAL APPLIANCE ASSOCIATION.—F. W. Edmunds, 3868 Park Ave., New York. Meeting with annual convention Railway Signal Association.

SOCIETY OF RAILWAY FINANCIAL OFFICERS.—Carl Nyquist, C. R. I. & P., La Salle St. Sta., Chicago.

SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. Ry., Atlanta, Ga.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Grant Bldg., Atlanta, Ga. Regular meetings, 3d Thursday, January, March, May, July, September, November, 10 A. M., Candler Bldg., Atlanta.

TOLEDO TRANSPORTATION CLUB.—Harry S. Fox, Toledo, Ohio. Regular meetings, 1st Saturday in month, Boody House, Toledo.

TRACK SUPPLY ASSOCIATION.—W. C. Kidd, Ramapo Iron Works, Hillburn, N. Y. Meetings with Roadmasters' and Maintenance of Way Association.

TRAFFIC CLUB OF CHICAGO.—W. H. Wharton, La Salle Hotel, Chicago.

TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 291 Broadway, New York. Regular meetings last Tuesday in month, except June, July and August, Waldorf-Astoria, New York.

TRAFFIC CLUB OF PITTSBURGH.—D. L. Wells, Erie R. R., Pittsburgh, Pa. Meetings bimonthly, Pittsburgh. Annual meeting, 2d Monday in June.

TRAFFIC CLUB OF ST. LOUIS.—A. F. Versen, Mercantile Library Bldg., St. Louis, Mo. Annual meeting in November. Noonday meetings October to May.

TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7122 Stewart Ave., Chicago. Annual meeting June 15, 1915, Minneapolis, Minn.

TRANSPORTATION CLUB OF DETROIT.—W. R. Hurley, Superintendent's office, L. S. & M. S., Detroit, Mich. Meetings monthly, Normandie Hotel, Detroit.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.

WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man. Regular meetings, 2d Monday, except June, July and August, Winnipeg.

WESTERN RAILWAY CLUB.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Regular meetings, 3d Tuesday in month, except June, July and August, Karpen Bldg., Chicago.

WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, 1735 Monadnock Block, Chicago. Regular meetings, 1st Monday in month, except January, July and August, Chicago. Extra meetings, except in July and August, generally on other Monday evenings.

Traffic News

The Illinois railways on October 16 filed tariffs with the Illinois Public Utilities Commission increasing freight rates in the state by 5 per cent, effective on November 15.

Plans are being made by the Atchison, Topeka & Santa Fe for establishing through passenger train service between Galveston and California points about November 1, via the Texico-Coleman cutoff.

The Panama Canal was closed to traffic five days, October 15-20, by a landslide in Culebra Cut. Fifteen ships were detained one or more days each, and will have claims on the government for demurrage.

Agents of the Grand Trunk Pacific are taking measures to get Belgian settlers for the territory opened by the company's lines in western Canada. It is expected that the European war will result in a rush of settlers to Canada. Belgian farmers are very thrifty people. It is hoped to settle a large tract in the Stuart river district.

The Boston & Maine has notified the governor of New Hampshire that it will enter suit in the Federal Court to resist the enforcement of the law of New Hampshire requiring the railroad to sell 500 mile books of tickets for $10. The Public Service Commission of that state has refused to approve the proposed increase of the mileage rate of 2¼ cents a mile.

The executives of the principal Missouri railroads held a conference on Monday, at Jefferson City, with Governor Major on the financial condition of the railroads in connection with the application of the roads for increases in rates. Among those present were President B. F. Bush of the Missouri Pacific, E. B. Pryor, receiver of the Wabash; W. C. Nixon, receiver of the St. Louis & San Francisco; F. H. Britton, president of the St. Louis Southwestern, and C. E. Schaff of the Missouri, Kansas & Texas.

For the first time in several years the railroads of Texas are able to take care of the autumn traffic without experiencing blockades of loaded cars of cotton at Galveston and at interior concentrating points. There is no complaint of car shortage. The traffic departments of the principal railroads of the state report that notwithstanding the absence of any general cotton movement a good business is being done. The marketing of this year's cotton crop will be so gradual and cover such a long period that, it is expected, there will be no burden on general traffic.

The production of explosives in the United States during the calendar year 1913, as reported by the United States Bureau of Mines, on the basis of figures received from manufacturers, was 231,757 tons, as compared with 244,696 tons in 1912. The total for 1913 is made up as follows: Black powder, 194,146,747 lb.; "high" explosives other than permissible explosives, 241,682,364 lb., and permissible explosives, 27,685,770 lb. How much of this enormous quantity of dangerous stuff was transported by railroad is not stated. The total amount of explosives used for the production of coal in 1913 was 209,352,938 lb.

Railroads leading from Richmond and Norfolk, Va., into North Carolina have reduced their interstate rates on potatoes and other vegetables. This reduction was made at the combined request of the Chambers of Commerce of Richmond, Norfolk and Petersburg. The former rates are restored. Two months ago the roads increased the rate by nearly 50 per cent. Producers and commission merchants immediately began to complain. The green vegetables particularly included are cabbage, potatoes, onions and turnips. The former rate from Richmond to Raleigh was 21 cents per 100 lb., and this was increased to 32 cents. Other changes were of similar character.

At the convention of the American Bankers' Association held at Richmond, Va., last week, a resolution was adopted declaring: "A prompt and liberal increase in railroad rates throughout the United States is essential in order to enable the railroads

to finance their maturing obligations. Such increase in rates must be made before we can hope to secure the confidence of the investing public both at home and abroad in railroad securities." The Interstate Commerce Commission was urged to act promptly and favorably upon pending applications for an increase of railroad rates, and to take such action as may produce a general and adequate increase in railroad revenues of this country.

The Illinois Manufacturers' Association has adopted resolutions to be placed before the Interstate Commerce Commission, endorsing the principle that the transcontinental railways should be allowed to put into effect such freight rates to the Pacific coast as will enable the central western territory to do business with the coast by rail, in competition with the industries of the eastern states. The resolution says: "The opening of the Panama canal has largely reduced the all-water rates between the [Atlantic] seaboard and adjacent territories and Pacific coast terminals. The Panama canal was built by public taxation, borne equally by all parts of the country. All parts of the country should therefore share equally in the benefits of the canal."

The Southern Pacific reports that during the period of colonist rates to California this year, from September 24 to October 8, over 10,000 people took advantage of the low rates. The tickets were all one-way tickets, which means that in the majority of cases the newcomers remained in California and had gone with the intention of remaining. That the newcomer may not be at a loss as to which way to turn upon arrival the company maintains a colonization bureau where information about every locality on the Pacific coast and the various agricultural, industrial and commercial opportunities is dispensed. The company's record of the colonist movement shows that the greatest travel was through the Ogden gateway.

Many complaints are being received by the North Carolina Corporation Commission that the intrastate freight rates recently put into effect in that state in accordance with the legislative action following the passage of the "Justice act" have worked serious disturbances in freight routes because of the rigidity of the long and short haul clause of the act. A number of short railroads are said to have been deprived of so much business that they will have difficulty in earning operating expenses. Following the adoption of the new class rates as agreed to under the Justice act, which agreement covers interstate rates, the principal roads filed tariffs discontinuing a large number of intrastate commodity rates; but the Corporation Commission refused to allow these new tariffs to go into effect.

Beginning November 1, shippers of grease, tallow and certain other inedible animal products who do an interstate or export business, must file certain declarations with the Secretary of Agriculture in Washington, and must furnish transportation companies with a shipper's certificate. The blanks for filing the required declarations may be procured from the Chief of the Bureau of Animal Industry in Washington. The regulations apply to grease-rendering establishments which prepare products unfit for human food, which are derived from cattle, sheep, swine or goats. Many of these products, though intended only for industrial use, cannot be denatured. In such cases the regulations provide that they may be transported in interstate or foreign commerce if both ends of the containers are painted white and conspicuously stenciled or burned with the true name of the product and the word "Inedible" in letters not less than two inches high.

California wine shippers will be saved thousands of dollars annually as the result of a new San Francisco-New York wine rate just announced by the Southern Pacific to go into effect November 15. The new rate gives the shipper a barreling-in-transit privilege that will enable him to ship in bulk in large tank cars to New Orleans, there transferring the wine into barrels for further shipment to New York by the Southern Pacific steamers. Under the old way, the shipper either sent the wine through by rail all the way in tank cars at 75 cents per 100 lb., or by rail and steamer in barrels at 55 cents per 100 lb. But to take advantage of the lower rate he had to pay the cost of transporting his cooperage products from the Middle West states to San Francisco. The new rate, which is also 55 cents per 100 lb., enables him to make use of the all-wood or steel and glass lined tank cars to New Orleans, at which point the shipment is transferred to barrels.

The transportation committee of the Cleveland Chamber of Commerce, through Traffic Commissioner D. F. Hurd, has submitted a report making an analysis of the Interstate Commerce Commission's decision allowing a 5 per cent advance in rates in Central Freight Association territory, as it affects Cleveland shippers. The report states that "the commercial relationships heretofore existing between Cleveland and many competing markets will be disturbed in a manner which it is quite evident will be unfavorable, if not detrimental, to Cleveland and other cities similarly affected." It is also stated that the carriers have construed the decision as giving permission to increase rates in Central Freight Association territory to apply in traffic destined to and from points west of the Mississippi river to the gulf of Mexico and the Great Lakes, exclusive of points covered by transcontinental tariffs, and that if rates to and from the western territory are made on the combination of locals based on Chicago and Mississippi river, or other established points, any increase in the rates from Cleveland and the other Central Freight Association points to those basing points will increase the total transportation cost. The report, therefore, objects to the increase in rates from Cleveland to Central Freight Association territory points while there are no increases from trunk line territory to those points.

American Association of Traveling Passenger Agents

The annual convention of the American Association of Traveling Passenger Agents was held on October 12, 13 and 14, at the Palace hotel in San Francisco, with over 300 members in attendance, the record for any convention of this association. Eighty-eight new members had been received during the past year. The principal topics of discussion at the meeting were: "Of what value will the Panama-Pacific International Exposition and the opening of the Panama Canal be to the world," and "Why is the traveling passenger agent of more importance today than he was during the old days of rate-cutting, rebating, etc." Thornwell Mullally addressed the meeting on behalf of the Panama-Pacific International Exposition, and Charles S. Fee, passenger traffic manager of the Southern Pacific, also addressed the meeting. On Tuesday afternoon a trip was made to Mount Tamalpais, and one day was spent inspecting the terminals on the bay and in going through the exposition grounds. On Friday the party left on special trains for a tour of southern California, stopping at Del Monte, Monterey, Los Angeles and San Diego. Those returning east planned to spend a day inspecting the new Union station at Kansas City. Officers were elected as follows: President, S. W. Manning, general New England agent, Atchison, Topeka & Santa Fe, Boston, Mass.; vice-president, W. D. Wood, traveling passenger agent, Wabash, St. Louis; secretary and treasurer, Elliott Monett, general western passenger agent, New York, Ontario & Western, Chicago (re-elected). Next year's convention will be held in Boston.

Railway Development Association

The annual convention of the Railway Development Association will be held in Chicago on November 10 and 11. The program includes an address of welcome by Mayor Harrison of Chicago, with a response by F. H. LaBaume, president of the association. "Personal Work with Farmers" will be discussed by M. V. Richards of the Southern, and H. M. Rainer of the Atchison, Topeka & Santa Fe. "Diversified Farming and Its Relation to the Cotton Grower" will be discussed by J. C. Clair of the Illinois Central, and J. F. Jackson of the Central of Georgia. H. B. Fullerton of the Long Island will present an address on plans for increasing the tonnage of agriculture for railroad transportation, illustrated with lantern slides. F. A. Spink, traffic manager of the Chicago & Western Indiana and the Belt Railway of Chicago, will discuss "The Relation of Railway Terminals to Industrial Development," and R. W. Cook of the Pennsylvania Lines West will discuss the "Advertising and Exploiting of Industrial Advantages." The semi-annual dinner of the association will be held on Tuesday evening, November 10, at which addresses will be made by W. L. Park, vice-president of the Illinois Central; George A. Blair, assistant freight traffic manager of the Chicago, Milwaukee & St. Paul, and Samuel O. Dunn, editor of the *Railway Age Gazette*.

Commission and Court News

INTERSTATE COMMERCE COMMISSION

Special Examiner George N. Brown, of the Interstate Commerce Commission, held a hearing at Kansas City on October 14, on rates on iron and steel products from Pittsburgh and Chicago and Missouri river points to Kansas, Oklahoma, Arkansas, Colorado and Utah.

On the petition of the Shreveport, La., Chamber of Commerce, Commissioner Hall, of the Interstate Commerce Commisison, will hold a hearing at Shreveport on October 27, on details of the Shreveport rate case which have not proved entirely satisfactory. One purpose of the hearing is to obtain a supplemental ruling to the original order to make it apply to all lines, instead of only to the Texas & Pacific and the Houston, East & West Texas.

Refrigeration Rates from New Orleans

Opinion by Commissioner McChord:

The commission finds that the carriers were justified in making a proposed increase in less than carload refrigeration charges from New Orleans and other points on the Illinois Central and Yazoo & Mississippi Valley to Chicago of 5 cents per 100 lb., minimum weight 10,000 lb., the service in this case being in charge of the Central Fruit Dispatch, a private car line, owned by the Illinois Central and furnishing refrigeration cars and service over the lines of the two defendants. (31 I. C. C., 637.)

Rice Rates from Helena, Ark.

Opinion by Commissioner Clark:

The commission finds that the carriers have justified proposed increases in rates on rice and rice products from Helena, Ark., to New Orleans and Vidalia, La., and Natchez, Miss., from 10 cents to 20 cents per 100 lb. in carloads, and from 15 cents to 25 cents per 100 lb. in less than carloads. For a number of years the carriers have maintained blanket rates on rice from points in the rice producing section of Arkansas, limited substantially in the territory extending about 140 miles north of Helena, and about the same distance south and west, of 20 cents per 100 lb. on carload and 25 cents on less than carload lots; there seems to be no reason why the rate from Helena should not be the same as the blanket rate. (31 I. C. C., 614.)

Hide Rates to Los Angeles, Cal.

Opinion by Commissioner Clark:

The commission finds that the carriers are justified in increasing to $1.20 a rate of 80 cents on hides to Los Angeles, Cal., from Lordsburg, N. Mex., and Southern Pacific main-line points west thereof; and also from Phoenix, Ariz., and points intermediate on the Arizona Eastern; and a rate of $1 from points on the main line of the Southern Pacific east of Lordsburg to and including El Paso, Tex., and from Nogales, Ariz., and points between Benson and Nogales. These rates were established to permit or facilitate concentration of hides at Los Angeles, from which shipments of that commodity are made to eastern manufacturing points. It was found, however, that competition at El Paso and Phoenix was put at a disadvantage by comparison. (31 I. C. C., 633.)

Rates on Flour from the Valley of Virginia

Stuarts Draft Milling Company et al. v. Southern Railway et al. Opinion by Commissioner Clark:

The commission finds that the present rates on flour and other grain products from mills at points on the Southern, Baltimore & Ohio, Chesapeake Western and Norfolk & Western in the valley of Virginia to Carolina territory are not unreasonable, it being of the opinion that the present rate adjustments which are of long standing are apparently fairly adapted to the needs of the communities and interests affected. The commission likewise holds that the higher rates applying on flour than on wheat are not discriminatory to the former commodity. It being held that the present rates are reasonable, it is found inadvisable to sanction the establishment of carload and less than carload rates in place of the any-quantity rates, because the result would be increased less than carload rates. The commission is also of the opinion that the any-quantity rates are entirely suited to the traffic on which they apply. (31 I. C. C., 623.)

Export Rates on Grain from Kansas City

Re export rates on grain and grain products from Kansas City, Mo., and Kansas City, Kan., to Port Arthur, Tex. Opinion by Commissioner Clark:

The Kansas City Southern, operating a direct line from Kansas City to Port Arthur, Tex., now maintains proportional rates on export grain and grain products from the former to the latter city of 18½ cents per 100 lb. on wheat and products of wheat, and 17½ cents on corn and products of corn regardless of point of origin. The commission finds that the carrier would be justified in establishing varying proportional rates, ranging from 13.6 to 18 cents on wheat, and from 12.1 to 17.72 cents on corn, dependent upon the point of origin on traffic originating at named points north of, but not including, the main line of the Union Pacific extending west from Kansas City. The tariff proposed, in reality, to establish through combination rates from the points of origin named to Port Arthur, which are equal to available through rates from the same points to Galveston, Tex., via other lines, whether the rates via the latter were jointly or were made on combinations. The commission finds, however, that certain unlawful features contained in the present tariff must not be permitted to become effective. It is ordered that certain violations of the fourth section contained must be avoided and that the tariff should contain a statement that the rates therein shall not be applicable to grain or grain products other than that which moves from point of origin subsequent to its effective date. The tariff should also specifically state that grain and grain products transported under the rates shall be governed by the rules and regulations prescribed in transit and reconsigning circulars of the Kansas City Southern. The tariff under consideration is to be cancelled, but another fulfilling the above requirements filed within three months of October 6 will be allowed to become effective upon not less than five days' notice. (31 I. C. C., 616.)

STATE COMMISSIONS

The Illinois Public Utilities Commission held a hearing at Chicago on October 20, on complaint from shippers at Granite City and East St. Louis that the railways have established a spotting charge of $2 per car at those points in addition to the usual switching charge.

At the request of the railways the Missouri Public Service Commission has changed from October 27 to December 1 the date for its hearing on the carriers' application for authority to increase freight, passenger and excess baggage rates throughout the state. The postponement was granted to give the roads more time in which to prepare data in support of their application.

The Arkansas Railroad Commission has issued a decision that claims for the payment of money under the commission's order providing a penalty of $5 per day for failure of railroads to transport freight at least 50 miles every 24 hours, must be prosecuted by the complainants in the courts and not before the commission. The ruling of the commission was handed down over the protest of Chairman McKnight, who contended that the commission had the power to hear such complaints and to assess the penalties.

The State Corporation Commission of Virginia has ordered the adoption, November 1, by the express companies, of a new tariff and classification for the transportation of merchandise. A "block system" for dividing the territory of the state has been adopted. It is like that of the Interstate Commerce Commission, but with modifications. The new tariff will make considerable reductions from the rates now in effect. On large packages of food products the rates are made in many instances considerably less than are those of the Interstate Commerce Commission for equal distances.

The California Railroad Commission has rendered a decision denying the application of the Southern Pacific to advance the trans-bay commutation fares between San Francisco and Oakland, Berkeley, Alameda and other Alameda county points. The commission stated, however, that the Southern Pacific should not be compelled to further extend the present 10-cent single fare and $3 commutation zone. The commission held that the company's apportionment of its investment and expenses as between main line service and suburban service was erroneous, taking the view that the suburban trans-bay service was in the nature of an auxiliary service, and that the commutation rates must necessarily be in the nature of wholesale rates. "Suburban traffic," said the commission, "is essentially a wholesale traffic; therefore, it is violative of fundamental rules of rate-making to apply units of expense and enforce divisions of property on an equality with a service which is essentially different and essentially retail." The commission also held that many of the Southern Pacific lines were built for competitive purposes and that where unnecessary duplication of investment has been made the burden should fall upon the Southern Pacific and not upon the patrons. "We do not think," said the commission, "that under the circumstances under which certain suburban lines were constructed in Oakland and Berkeley, this company has any right to impose upon its patrons a rate sufficient to return it the amount which otherwise should be returned on the ground that it has constructed facilities in excess of the necessity of the patrons." The case was originally instituted by the residents of one of the suburban communities, who filed a complaint for the purpose of compelling a reduction in the fares from San Francisco. The company presented evidence showing that on the 877 suburban trains operated daily out of the Oakland and Alameda moles in connection with the trans-bay ferry service, carrying nearly 14,000,000 passengers per year, the loss for the fiscal year ended June 30, 1913, approximated $364,000, without taking into consideration interest on the investment, the valuation of which was placed at $46,209,560.

PERSONNEL OF COMMISSIONS

A. J. Cunningham, general foreman of the Atchison, Topeka & Santa Fe at Barstow, Cal., has been appointed inspector of motive power for the Pacific district, division of valuation, Interstate Commerce Commission, with headquarters at San Francisco, Cal.

W. J. Thomas has been appointed inspector of car equipment for the Pacific district, division of valuation, Interstate Commerce Commission, with headquarters at San Francisco, Cal. Mr. Thomas recently has been employed in the United States Interior Department at Los Angeles, and formerly was in railway service.

COURT NEWS

Charles J. Spencer, of Elizabeth, N. J., filed suit in the United States Court of Appeals at Cincinnati, on October 1, to enjoin the proposed consolidation of the Lake Shore & Michigan Southern and New York Central & Hudson River.

The Ann Arbor Railroad has applied to the United States District Court at Detroit for an injunction restraining the state authorities from interfering with the road in case it advances its passenger fare from 2 cents to 3 cents a mile.

Judge Dyer of the United States District Court at St. Louis, Mo., has rendered a decision that the federal courts have no jurisdiction in the cases of the state against the Atchison, Topeka & Santa Fe and the Chicago, Burlington & Quincy, involving the return of alleged overcharges on state freight and passenger rates for the time during which the state rates were under injunction. The decision sustained the contention of the Attorney-General of Missouri, that the cases be remanded to the state courts, from which they had been taken by the railroads.

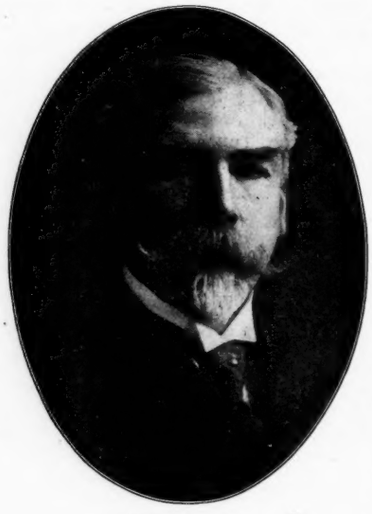
RAILWAY EXTENSION IN ARGENTINA.—The government of the Argentine province of Entre Rios has given its sanction to a project for the construction of a light railway between the port of Parana and the irrigated zone of the Las Conchas river.

Railway Officers

Executive, Financial, Legal and Accounting

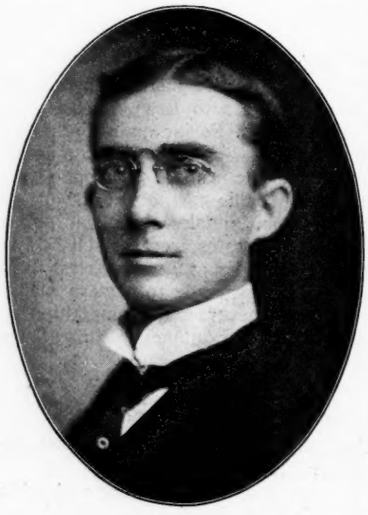
A. R. Wood has been appointed assistant auditor of the San Antonio & Aransas Pass, with headquarters at San Antonio, Tex.

Thomas John Kennedy, whose election as president and general manager of the Algoma Central & Hudson Bay, and the Algoma Eastern, with headquarters at Sault Ste. Marie, Ont., has already been announced in these columns, was born at Campbellford, Ont., and was educated in the high school at Port Hope. He began railway work in 1874, on the engineering staff of the Canadian Pacific, and in 1881, became engineer for contractors at work on a section of the same road. In 1885 he was appointed roadmaster on the Lake Superior division of the Canadian Pacific; in 1892 he was appointed superintendent at Chapleau, Ont., and in 1899 was transferred as superintendent to the North Bay division of the same road. He was then consecutively general superintendent and traffic manager of the Algoma Central & Hudson Bay and the Algoma Eastern; manager of the International Transit Company and the Trans.-St. Mary's Traction Company, with headquarters at Sault Ste. Marie, Ont., and was president of the Superior Construction Company, Ltd., at Sudbury, Ont., at the time of his recent election as president of the Algoma Central & Hudson Bay, and the Algoma Eastern as above noted.



T. J. Kennedy

Thomas A. Clarkson, for the past seven years secretary to E. C. Lewis, chairman of the board of directors of the Nashville, Chattanooga & St. Louis, has been elected secretary of that company, with headquarters at Nashville, Tenn. Mr. Clarkson has been in railway service for 26 years, having begun railway work as a clerk in the accounting department.



T. A. Clarkson

W. N. Jones has been appointed claim agent of the Western division of the Chicago & Alton at Mexico, Mo., succeeding B. A. Sturdevant, who has been transferred to Bloomington, Ill., as claim agent of the Northern division, in place of H. S. Simpson, resigned.

Arthur S. Pierce, assistant treasurer and assistant secretary of the Chicago & North Western at New York, has been elected treasurer and assistant secretary, succeeding Milton B. Van Zandt, deceased. The following appointments have also been announced: T. W. Arundel, assistant treasurer and secretary, and H. W. Rush, assistant treasurer and assistant secretary. All will have their headquarters at New York.

J. W. Everman, general manager of the St. Louis Southwestern of Texas, has been elected first vice-president and general manager, and first vice-president of the Stephensville North & South Texas, with headquarters at Tyler, Tex.

Fred Zimmerman, general freight agent of the Lake Shore & Michigan Southern at Cleveland, Ohio, has been elected vice-president in charge of traffic of the Chicago, Indianapolis & Louisville, with headquarters at Chicago, effective November 1. A photograph of Mr. Zimmerman and a sketch of his railway career were published in the *Railway Age Gazette* of March 20, 1914, page 700.

Operating

T. E. Coyle has resigned as superintendent of the Pasco division of the Northern Pacific at Pasco, Wash.

R. M. Johnson has been appointed superintendent of transportation of the Coal & Coke, with headquarters at Gassaway, W. Va., succeeding C. S. Wilkins, resigned.

L. M. Dooley, inspector of transportation of the Texas & Pacific, has been appointed superintendent of the Rio Grande division, with headquarters at Big Spring, Tex., succeeding W. M. Lynch, who has been transferred to the New Orleans division as superintendent, with office at New Orleans, in place of T. S. Mahoney, transferred. R. B. Ayres, superintendent of the Trans-Continental division at Texarkana, Tex., who has been assigned to other duties, is succeeded by T. S. Mahoney.

Traffic

A. D. Pinkerton has been appointed commercial agent of the International & Great Northern at Galveston, Tex.

Frank Koch has been appointed general agent, freight department, of the International & Great Northern at New Orleans, La.

Logan A. Mizener, commercial agent of the Chicago, St. Paul, Minneapolis & Omaha at Minneapolis, Minn., has been appointed general agent at Sioux City, Iowa, succeeding H. G. Wiringer.

W. T. Webster, whose appointment as general freight agent of the Chicago, Indianapolis & Louisville, with headquarters at Chicago, has already been announced in these columns, was born August 21, 1872, at Jackson, Mich., and was educated in the public schools at Jackson and Kalamazoo. He began railway service in 1886 with the Chicago, Kalamazoo & Saginaw, and for four years was employed in the accounting and traffic departments of that road at Kalamazoo. From 1890 to May, 1896, he occupied various positions in the freight departments of the Grand Trunk, the Michigan Central and the Pere Marquette, including that of chief rate clerk in the general freight department of the latter road at Grand Rapids, Mich. Mr. Webster then went to the Chicago, Indianapolis & Louisville as Michigan representative, and subsequently was for 15 years commercial agent at Grand Rapids. In July, 1911, he was appointed general agent at Chicago, and one year later became division freight agent at Bedford, Ind., from which position he was promoted to general freight agent on October 1, as above noted.

W. T. Webster

E. P. Vernia, agent of the Chicago, Indianapolis & Louisville at New Albany, Ind., has been appointed division freight agent, with office at Bedford, Ind., succeeding W. T. Webster, promoted.

G. M. Schaefer, traveling freight and passenger agent of the Wabash, with headquarters at Portland, Ore., has been appointed general agent at that place, succeeding C. A. Pettibone, deceased.

C. D. Thompson has been appointed general agent of the Great Northern at Spokane, Wash., in place of D. G. Black, who has been transferred to St. Louis, Mo., succeeding R. K. Pretty, who has been appointed agent at Seattle, Wash.

Frank B. Humston, city passenger and ticket agent of the Chicago, Indianapolis & Louisville at Bloomington, Ind., has been appointed district passenger agent at Indianapolis, Ind., succeeding H. G. Alexander, resigned to engage in other business.

H. F. Harden, traveling freight agent of the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern at Jacksonville, Fla., has been appointed commercial agent of both roads, with headquarters at Indianapolis, Ind., succeeding S. A. Williams, resigned.

C. E. Stone, president of the Kaslo & Slocan Railway, Land Grant Development Company, Limited, of St. Paul, Minn., and formerly general passenger agent of the Great Northern, has been appointed general traffic manager of the Great Northern Pacific Steamship Line, with headquarters at San Francisco, Cal.

E. P. Cockrell, assistant general passenger agent of the Chicago, Indianapolis & Louisville at Chicago, has been appointed general passenger agent, with office at Chicago, succeeding Frank J. Reed, who requested relief from the responsibilities of that position on account of illness, after 29 years' service, and has been appointed a special representative of the passenger department. Charles M. Woodman, chief clerk in the passenger department, succeeds Mr. Cockrell. Effective January 1.

Engineering and Rolling Stock

The statement published in our issue of September 25, announcing the resignation of W. D. Minton, master car builder of the Texas & Pacific at Marshall, Tex., was in error. Mr. Minton still retains the position mentioned.

J. D. Lovell, supervisor of the Pennsylvania Railroad at Tyrone, Pa., has been transferred as supervisor to East Brady, succeeding W. S. Johns, Jr., transferred. R. R. Nace, supervisor at Buffalo, N. Y., has been transferred as supervisor to the office of the valuation engineer at Philadelphia, Pa. J. S. Considine, supervisor at Driftwood, Pa., succeeds Mr. Nace. H. S. Trimble, supervisor at Irvona succeeds Mr. Considine, and R. A. Klein, supervisor of the Camden Terminal division and the West Jersey & Seashore at Camden, N. J., succeeds Mr. Pitcairn. A. E. Preble, supervisor of the Cumberland Valley at Chambersburg, Pa., succeeds Mr. Klein, and N. B. Pitcairn, supervisor at Verona succeeds Mr. Preble.

Joseph Billingham, whose appointment as superintendent of motive power of the Grand Trunk Pacific, with headquarters at Transcona, Man., has already been announced in these columns, began railway work as machinist apprentice on the Great Northern Railway of England, and subsequently was a machinist in the shops of the Chicago & North Western. He served later as a locomotive engineer and road foreman of engines on the Chicago, Milwaukee & St. Paul. In December, 1890, he was appointed road foreman of engines of the Gulf, Colorado & Santa Fe. He was subsequently master mechanic and general master mechanic on the same road, and the division master mechanic on the Baltimore & Ohio. In January, 1904, he was appointed representative of the Galena Signal Oil Company at London, Eng., and at the time of his recent appointment as superintendent of motive power of the Grand Trunk Pacific, was general inspector of the American Locomotive Company at Schenectady, N. Y.

OBITUARY

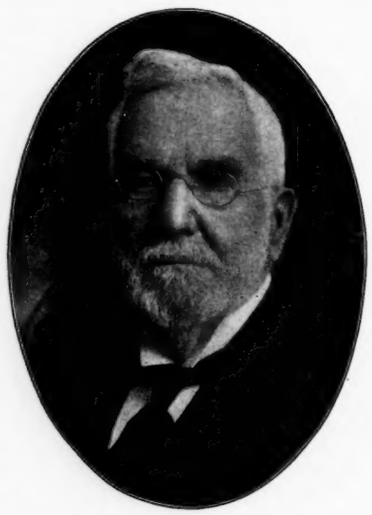
Stephen W. White, formerly assistant secretary of the Pennsylvania Lines West of Pittsburgh and secretary of the Northern Central at Philadelphia, Pa., died on October 16, at his home in Philadelphia, at the age of 74. He entered the service of the Northern Central in 1875 as assistant secretary; two years later he was appointed secretary of the same road, and from 1881 was also assistant secretary of the Pennsylvania Lines West until his retirement in 1910 under the pension rules.

Charles Otey Gwatkin, who in recent years had been engaged in special work for the Northern Navigation Company and the Grand Trunk Railway, died at Sarnia, Ont., October 9, at the

age of 64 years. He was born at Lynchburg, Va., November 9, 1850, and began railway work in 1880 as agent for the Great Western Despatch Fast Freight Line at Binghamton, N. Y. In October, 1885, he was made traveling freight agent of that line at Boston, Mass., and subsequently was with the Wisconsin Central Lines as New England agent, commercial agent at Boston, and general eastern agent at New York, until May, 1900. Later for a period of two years he was general manager of the Guatemala government railways, and previous to his connection with the Grand Trunk and the Northern Navigation Company he was employed as traffic manager for an industrial concern in the east.

Charles J. Drury, master mechanic of the Atchison, Topeka & Santa Fe, whose death was noted in our issue of October 16, was 36 years of age. He was born at Chicago Junction, Ohio, and began railway work in July, 1895, as machinist apprentice for the Atchison, Topeka & Santa Fe. After completing his apprenticeship in July, 1899, he was employed as machinist for that road, the Southern Pacific, the Kansas City Southern, the El Paso & Southwestern, the Chicago, Rock Island & Pacific and other roads for seven years, becoming roundhouse foreman for the Santa Fe at La Junta, Colo., in July, 1906. He remained with the Santa Fe until February, 1913, filling the positions of general foreman at Albuquerque, N. M.; bonus supervisor of the Western Grand division; master mechanic of the Oklahoma division at Arkansas City, Kan., and master mechanic of the Plains division at Amarillo, Tex. He then became master mechanic of the St. Louis & San Francisco at Ft. Smith, Ark., and the following February was appointed superintendent of shops at Springfield, Mo. Mr. Drury was promoted to division master mechanic at Sapulpa, Okla., on September 1, just prior to his illness of typhoid fever, from which he died on September 30. Mr. Drury's father, M. J. Drury, is superintendent of shops of the Santa Fe at Topeka, Kan.

Oliver S. Lyford, vice-president of the Chicago & Eastern Illinois, who died on October 12, after 68 years of railroad service, as mentioned in our issue of last week, was born June 19, 1823, at Mount Vernon, Maine. His record is one of the most remarkable in railroad history. He began work in January, 1846, with the Boston & Lowell, remaining with that road until February, 1851, successively as watchman, assistant baggage man, ticket agent and extra passenger conductor. He then went to the Erie as shop clerk at Dunkirk, N. Y., and from November, 1851, to October, 1855, was a passenger conductor. In October, 1860, he became joint station agent of the Erie and the Atlantic & Great Western at Salamanca, N. Y.; from November, 1863, to April, 1869, was division superintendent of the latter road, and then until November, 1871, was assistant general superintendent. The following eight months he was superintendent of the Buffalo and Rochester divisions of the Erie, leaving that road in July, 1872, to become general superintendent of the Hannibal & St. Joseph, where he remained until November, 1873. From December, 1874, to November, 1876, Mr. Lyford was general superintendent of the Kansas Pacific, and in January, 1878, he became connected with the Chicago & Eastern Illinois as superintendent. He was appointed general manager in February, 1886, and in November of the following year became vice-president and general manager. He relinquished the duties of general manager in February, 1890, but retained the office of vice-president until he was formally retired on July 1, 1913. Of recent years he had not been active in railroad service, but went to his office nearly every day until his retirement and occasionally afterward.



O. S. Lyford

Equipment and Supplies

LOCOMOTIVE BUILDING

THE UNION PACIFIC has ordered one snow plow 12 ft. cut, from the American Locomotive Company.

THE MINNEAPOLIS & ST. LOUIS has ordered 15 Mikado type locomotives from the American Locomotive Company.

CAR BUILDING

ATLANTIC COAST LINE.—A report in the Advance Sheet of October 7 to the effect that this company was in the market for 500 freight cars, has been denied.

THE NORTHERN PACIFIC is in the market for 47 coaches and 18 combination mail and express, 4 combination mail and baggage, 17 baggage, 6 dining and 3 tourist cars.

THE LOUISVILLE & NASHVILLE, reported in the *Railway Age Gazette* of last week as having purchased 1,000 underframes, will use part of these underframes for the following cars to be built in its own shops: 450 50-ton drop bottom gondola cars; 200 40-ton box cars and 75 40-ton refrigerator cars. The underframes for 250 of the gondola cars were purchased from the American Car & Foundry Company, and the remainder from the Mount Vernon Car Manufacturing Company.

IRON AND STEEL

THE MINNEAPOLIS & ST. LOUIS has ordered 1,500 tons of 85-lb. steel rails from the Illinois Steel Company.

THE CHICAGO, MILWAUKEE & ST. PAUL has ordered 238 tons of steel for five 90-ft. deck girder spans, from the Wisconsin Bridge & Iron Company.

THE INTERNATIONAL & GREAT NORTHERN has ordered 852 tons of steel for bridges at Riverside and Long Lake, Tex., from the Wisconsin Bridge & Iron Company.

SIGNALING

The Buffalo, Rochester & Pittsburgh has put in service automatic block signals on its line between Buffalo and East Salamanca, about 63 miles. With this addition the company now has 215 miles of road equipped with automatic block signals.

The Central of Georgia has awarded the Union Switch & Signal Company the contract for installing an electro-pneumatic push-button switch apparatus at its classification yard, at West Macon, Ga.; also a mechanical interlocking plant at the west end of the receiving yard at Macon, and automatic block signals between Macon Junction and Terra Cotta. The semaphores will be style "S." The push-button machine will have 22 buttons.

A RUSSO-PERSIAN RAILWAY.—A party of Russian engineers which late in June reached Enseli for the purpose of surveying for the proposed railway route from Enseli to Resht and thence to Kasvin, must by this time have made considerable headway. The survey is being conducted under the guidance of the engineer Yarosh. The proposed line is to serve as an extension of that already selected from the station of Alyat, near Baku, to Astara, and thence along the shore of the sea to Resht. The Enseli-Resht-Kasvin route, the total length of which is 228 miles, will follow the existing paved road crossing the high Elburg mountain range near Kuin. The projected railway from Alyat station to Kasvin, about 400 miles long, is to connect Central Persia with Russia. There is a good paved road from Kasvin to Teheran—distance, 90 miles. The most important section is that connecting Enseli and Kasvin, as this gives an outlet to the sea from the richest provinces of Persia—Chamse, Kasvin and Hamadan. This line also will facilitate the transport of Russian goods into Persia.

Supply Trade News

The Q. & C. Company, New York, has taken over the exclusive license and control of the Ross-Schofield system of water circulation for locomotive boilers for the United States and Canada.

At the annual meeting of the American Locomotive Company in New York on October 20, retiring directors W. H. Marshall, A. H. Wiggin and A. W. Mellon were re-elected to serve for three years. The present officers of the company were likewise re-elected to serve for the following year.

Henry H. Westinghouse, brother of the late George Westinghouse, was elected president of the Westinghouse Air Brake Company at the annual meeting on October 15. Mr. Westinghouse has been associated with the company for over 40 years. He was born at Central Bridge, Schoharie county, N. Y., on November 16, 1853. He received his early education at Union High School, Schenectady, graduating in 1870. In 1871 he entered Cornell University to take up the study of mechanical engineering. In 1872 he went to Pittsburgh and became identified with the business of the Westinghouse Air Brake Company. He worked successively in the foundry, machine shop and drafting room, and occupied the positions of general agent, general manager, vice-president and acting president. He was also one of the founders of the firm of Westinghouse, Church Kerr & Company, and for many years was the guiding spirit in its management. Mr. Westinghouse is a man of quiet tastes and unostentatious manner. He is a member of the Grolier, Century, Engineers' and Cornell clubs of New York, and the American Society of Mechanical Engineers. He is also a trustee of Cornell University.

H. H. Westinghouse

John Steele Patterson, for the past 24 years resident manager of the Galena Signal Oil Company, Franklin, Pa., at Cincinnati, Ohio, died at his home in that city on October 13. Mr. Steele was born in Baltimore, Md., on February 13, 1839. He served his term as machinist's apprentice in the shops of the Baltimore & Ohio at Cumberland, Md., and was later general foreman in the Baltimore & Ohio shops at Portsmouth, Ohio. When he was 24 years of age he was appointed master mechanic of the Cincinnati, Indianapolis, St. Louis & Chicago, now the Big Four, at Cincinnati, and served in that position for 25 years. For the past 24 years he had been connected with the Galena Signal Oil Company as noted above.

TRADE PUBLICATIONS

Automatic Stokers.—The Sanford Riley Stoker Company, Ltd., Worcester, Mass., has recently issued a well illustrated catalog descriptive of the Riley Self-Dumping Underfeed Stoker, and showing some of the installations that have been made. This stoker is an improvement on many, in that there is a continuous movement of the fuel bearing surfaces, together with a continuous automatic cleaning. The reciprocating movement of the fuel bearing surfaces in it automatically gives a slicing effect in the fuel bed and tends to prevent the formation of clinker.

Enlistments of English Railway Employees.—The October number of the Great Western Railway's magazine states that the company has 7,595 of its men with the colors.

Railway Construction

Arizona Roads.—Announcement is made that the Gunn-Thompson Company will build a railroad from a connection with the Arizona Eastern at Webster, Ariz., northeast to its mines at Superior, about 20 miles.

Athabasca Valley.—Application is being made to the Alberta legislature for an extension of time in which to build this projected line from near Independence, Alta., on the Edmonton, Dunvegan & British Columbia northwest to Fort Assiniboine, about 75 miles. J. D. McArthur, Winnipeg, Man., is the principal promoter.

Canadian Northern.—A contract is reported let to the Northern Construction Company to build south from Macleod, Alta., and a contract has been given to the McArthur Construction Company to build a section of about 25 miles on a line to St. Paul de Metis.

Carmack Railway & Power Company.—Plans are being made to build a 7-mile line, it is said, from Opelika, Ala., southwest to Auburn, as soon as financial arrangements can be made. H. A. Bedell, president; W. L. Carmack, vice-president and general manager, and F. Pace, chief engineer, Opelika.

Horse Creek Land & Mining Company's Line.—We are told that this company is planning to build a line along Peter Cave Fork, in Lincoln county, W. Va., and that the work includes cuts and fills on about 2.2 miles. When completed the line is to be operated by the Chesapeake & Ohio. A report says that the line may be extended an additional 10 miles. L. E. Poteet, general manager, Charleston, W. Va.

Kinston Carolina Railroad & Lumber Company.—It is said that this company, which now operates a 20-mile line from Kinston, N. C., south to Pink Hill, will build an extension as soon as financial arrangements can be made. The projected route is from Pink Hill south to either Chinquapin, 20 miles, or to Maple Hill, 35 miles.

Lake Huron & Northern Ontario.—An officer writes that the contract has been let to the Ontario Northern Construction Company, with headquarters at Bruce Mines, Ont., on a percentage basis to build a 325-mile extension from Bruce Mines northerly. Work may be started in January on the heavier sections of the line, and the company expects that about 50 miles will be completed, by July or August of next year. The maximum grade north will be 1 per cent, and south 0.6 per cent, and the heaviest curves will be 6 deg. The principal commodity to be carried on the line for the first few years will be timber. G. P. McCallum, president; H. Appleton, vice-president and general manager, Bruce Mines. (October 9, p. 670.)

Mexican Roads.—Colonel Federico Montes, governor of the state of Queretaro, has adopted plans, it is said, for the construction of several hundred miles of railroad, in order to give employment to the many idle men in that state. Surveys are now being made for a line to be built from Queretaro, Mex., northeast to the port of Tampico, also for a line from Queretaro southwest to Acambaro.

Norfolk, Yorktown & Washington.—Surveys are now being made, it is said, to build the line projected last year from a point in Gloucester county, Va., north via Fairfax, about 160 miles. W. H. Edwards, Newport News, Va.; C. T. Hobart and W. W. Terry, of Norfolk, may be addressed.

Oregon Roads.—We are told that residents of Roseburg, Ore., on October 5, voted to issue $500,000 of bonds in aid of a projected railway from Roseburg west to a point on the Pacific coast, probably at Coos Bay, about 90 miles. The Roseburg Railroad Commission has been created to carry out the construction of the line and to sell the bonds. W. H. Richardson, secretary, Roseburg. (May 29, p. 1215.)

Orleans-Kenner Electric Interurban.—This company is building a line from New Orleans, La., west to Kenner, about 14 miles, and on completion of the work will build an extension, it is said, from Kenner, northwest. H. K. Johnson, president, New Orleans.

Pacific Great Eastern.—This company, which is building from Vancouver, B. C., north to Prince George, 480 miles, has been authorized to open for traffic the section from Lonsdale avenue, North Vancouver, to Horse Shoe Bay or Whitecliffe, 12.7 miles. The line is under construction from this point to Squamish, at the head of Howe Sound, and is in operation north of Squamish via Cheakamus on about 20 miles. The grading work is finished to Lillooet, 100 miles from Vancouver, and track laying is now under way. It is expected that track laying and ballasting on this section will be finished this year. The remaining section from Lillooet north to Prince George on the Grand Trunk Pacific is all under contract. (July 10, p. 80.)

Princeton Power Company's Line.—Construction work has been started at Princeton, W. Va., it is said, on an electric railway to be built to Bluefield, 12 miles. Walton & Company, Falls Mills, Va., are the contractors.

Swift Lumber Company's Line.—This company has under consideration the question of building a line, it is said, from Meigs, Ga., southeast via Coolidge to Pavo.

Van Horn Valley Land & Railway Company.—This company has awarded a contract to King & Runquist, Duluth, Minn., for the construction of a standard gage railway extending from Van Horn, Tex., up through the Van Horn Valley to a point near the New Mexico boundary. This line, when completed, will be 90 miles long and will tap a 350,000 acre tract of land owned by this company in the Van Horn valley in El Paso and Culberson counties, Tex. Construction work is to begin immediately.

West Penn Traction Company.—An officer writes that all the material has been bought to carry out work on an extension of its Oakdale and McDonald branch to Burgettstown, Pa.

Wilmington & Carolina Beach (Electric).—Residents of Wilmington, N. C., recently voted to grant a franchise to this company which proposes to build from Wilmington to Carolina Beach, 13 miles. In addition the company plans to build 11 miles of city lines. C. C. Chadbourn, president, and J. F. Heyward, chief engineer. (August 21, p. 370.)

RAILWAY STRUCTURES

Ludlow, Ky.—Plans have been made for building a new concrete viaduct at Elm street, it is said, over the tracks of the Queen & Crescent in Ludlow at an estimated cost of $34,600.

Louisa, Ky.—A contract has been given by the Chesapeake & Ohio, to the Virginia Concrete Company, Roanoke, Va., it is said, to build a bridge over the Levisa Fork of the Big Sandy river, about three miles from Louisa.

New York.—The contract for building the post office, express and office building for the New York Central & Hudson River in the Grand Central Terminal has been let to the John Peirce Co., New York, and the work will be started at once. The structure will cover an area of about 52,230 sq. ft., between Forty-fifth and Forty-sixth streets, Lexington avenue and Depew place, and will harmonize in architectural features with the adjacent terminal buildings. At the present time the building will not be erected above the fourth floor, though provision is made for future erection of eight additional floors. The floor at the Lexington avenue level will be arranged to accommodate increased express business handled at the terminal, and wagon-loading space, also drives to street and connections to the track level will be provided. The two next floors above will be occupied by the railway mail service and the New York post office in handling second class and parcel post matter. Wagon-loading space will be provided along the private street at the west side of the building, and a comprehensive system of mail conveying equipment will be installed to distribute the mail within the building and to and from the trains beneath. (September 4, p. 453.)

Ogden, Utah.—A contract has been given to C. F. Dinsmore, Ogden, Utah, it is said, for putting up a union station to be used by the Ogden Rapid Transit Company and the Salt Lake & Ogden Railway. The proposed structure is to be built on Twenty-fourth street, and will be 50 ft. wide by 270 ft. long. The cost of the work is about $25,000.

Railway Financial News

Cincinnati, Hamilton & Dayton.—Gordon Abbott, a director of the Old Colony Trust Company, Boston, has been added to the protective committee of the Cincinnati, Hamilton & Dayton, which consists of Charles H. Sabin, Harry Bronner, S. L. Fuller and J. H. McClement.

Baltimore & Ohio.—The Quemahoning branch, a subsidiary of the Baltimore & Ohio, has filed a notice with the Pennsylvania Public Service Commission of an increase in funded debt of $5,000,000.

Chesapeake & Ohio.—Frank Vanderlip has resigned as a director and as a member of the executive committee.

Denver & Rio Grande.—Edwin Gould has resigned as a director.

Hocking Valley.—This company has made arrangements through Kuhn, Loeb & Company and the National City bank, both of New York, for the refunding of $4,000,000 5 per cent notes, maturing November 1, 1914, through the sale of $4,000,000 one-year 6 per cent notes, due November 1, 1915.

New York Central & Hudson River.—The suit brought by minority stockholders to prevent the carrying out of the merger plans of the Lake Shore & Michigan Southern and the New York Central & Hudson River has been dropped by the consent of both parties and by consent of the United States district judge, before whom the suit was brought.

New York, New Haven & Hartford.—The final decree in the dissolution suit proceedings, the form of which was worked out by the various interests, has been signed by Judge Mayer, in the United States district court.

William Skinner and Morton F. Plant have resigned as directors

Wabash.—The organization committee last week notified the state public service commissions of Illinois and Missouri of the withdrawal of the plan of reorganization submitted last May, with the explanation that it is useless to attempt to carry it out. The committee explained the situation in part as follows:

"In reaching its decision to take the course now indicated the committee has not treated as a decisive condition of this matter the unparalleled catastrophe of the war which now devastates Europe."

"With the largest volume of business and the largest amount of gross earnings realized in any year, except one, in the history of the property, with completed expenditures of $10,500,000 in improvement and equipment, the operating income of the property was for the fiscal year just closed the smallest realized in any year, save two, during the period of 10 years last past.

"Increased operating costs, increased taxes and reduced rates have produced the result that for this year of large business the earnings of the property applicable to the payment of fixed charges fell over $375,000 short of providing for the interest on underlying mortgages, and provided no return whatever on the large capital expenditures made during the receivership.

"Since 1908 the taxes on the property have increased 44 per cent.

"Passengers are now carried on the Wabash Railroad at the rate of one-tenth of a cent per mile less than it costs the railroad to run its passenger service; freight is carried at a revenue of only a little over one-tenth of a cent per ton per mile over the cost of carrying it.

"There can be but one of two outcomes—disaster to the railways and all the railways represent in their relations to investments, savings, insurance and to general business, as well as to public requirements and convenience; or an intelligent reversal of the policy which has been carried so far beyond the interests and demands of the people and so far beyond the remedy for evils sought to be corrected."

Judge Mayer, in the United States district court, refused to grant a stay in the proceedings looking to the foreclosure of the mortgage, of which the Central Trust Company is trustee.